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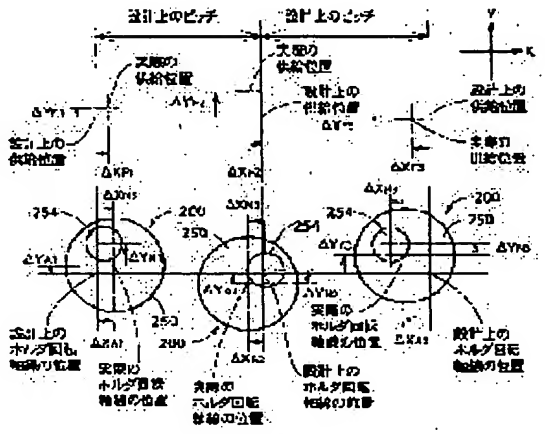
(54) METHOD FOR FEEDING ELECTRIC COMPONENT AND SYSTEM FOR MOUNTING ELECTRIC COMPONENT

(57)Abstract:
PROBLEM TO BE SOLVED: To suck an electric component through a plurality of suction nozzles simultaneously and stably.
SOLUTION: A plurality of suction nozzles 200, each having eccentric suction tube and nozzle body, are arranged in the X-axis direction on the X-axis slide of an XY robot. Positional error of feeding position, eccentricity of the suction plane 254, and positional error of the rotational axis of a holder are acquired by picking up the image of the suction plane 254 and a gauge tape set in a plurality of feeders. At the time of receiving an electronic component 20, the nozzle holder is rotated and the suction plane 254 is turned to adjust the distance between the centers of three suction planes 254 thus aligning the suction plane 254 with the electronic component in the X-axis direction. Subsequently, it is aligned with the electronic component in the Y-axis direction by adjusting the position for stopping feeding of the electronic component thus sucking the electronic component through three suction nozzles 200 simultaneously and stably. Alternatively, the suction plane 254 may be aligned with the electronic component in the X-axis direction by shifting the nozzle holder in the X-axis direction thereby adjusting the distance between the axes.



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* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] While putting in order and installing two or more feeders which arrange an electrical part in one train and are sent to a components feed zone in the feed direction of these feeders, and the right-angled direction Put in order the nozzle holder which holds an adsorption nozzle, respectively in the direction of a list of said feeder, and it is made to hold to one migration member. It is the approach of sticking to each of two or more adsorption nozzles made holding to these nozzle holders with negative pressure, and making it taking out an electrical part from each of said feeder. At least by one side of adjusting the distance of said direction of a list between the shafts of some [at least] things of two or more of said adsorption nozzles, and adjusting the delivery halt location of said electrical part in each of two or more of said feeders The electrical-part supply approach which performs alignment of the electrical part supplied by two or more feeders, and the thing of a part of at least two or more of said adsorption nozzles, and is characterized by these things [making two or more electrical parts stick to some adsorption nozzles simultaneously] even if few.
[Claim 2] The electrical-part supply approach according to claim 1 characterized by adjusting the delivery halt location of an electrical part by using what sends an electrical part by sending the carrier tape of the longitudinal configuration which puts in order and holds an electrical part in one train as said feeder to a longitudinal direction, and adjusting the delivery halt location of a carrier tape.
[Claim 3] Two or more feeders which compare an electrical part with the substrate supporting structure holding the circuit board in one train, and are sent to a components feed zone Each feed direction of these feeders becomes parallel to the first straight line on a base plane parallel to the front face of the circuit board held at said substrate supporting structure. Two or more adsorption nozzles in and the condition that they are located in a line in the direction parallel to said second straight line, with the feeder supporting structure held in the condition of standing in a line in the direction parallel to the second straight line on said base plane where the components feed zone of these feeders intersects the first straight line It holds pivotable around axis of rotation respectively right-angled to said base plane. And a migration member with self movable in the location of the arbitration of said base plane, The delivery halt centering-control equipment which adjusts the halt location of a direction parallel to said first straight line in said components feed zone of the electrical part in each of two or more of said feeders, By controlling at least at least one side and one side with the wheel base adjustment which adjusts the wheel base of a direction parallel to said second straight line of some [at least] things of two or more of said adsorption nozzles One [at least] relative position of a direction parallel to said first straight line with the electrical part supplied by some [said / at least] an adsorption nozzle and said two or more feeders and a direction parallel to said second straight line is adjusted. The electrical-part wearing system characterized by including the components receipt control unit which carry out adsorption maintenance of two or more electrical parts all at once in some [said / at least] adsorption nozzles.
[Claim 4] The electrical-part wearing system according to claim 3 characterized by including the electric motor control unit which adjusts the delivery halt location of said electrical part when it has the feed gear with which said feeder makes a driving source the electric motor which can control angle of rotation and said delivery halt centering-control equipment controls the electric motor.
[Claim 5] The electrical-part wearing system according to claim 3 or 4 characterized by for said migration member holding two or more nozzle holders pivotable to the circumference of axis of rotation to which said base plane and some [at least] things of a list and the nozzle holder of these plurality cross at right angles respectively in the direction parallel to said second straight line, and said wheel base adjustment containing two or more these holder slewing gear with which arbitration can carry out the include-angle revolution of some nozzle holders according to an individual even if few.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to improvement in the receipt precision of the electrical part especially supplied by the feeder about the electrical-part supply approach and an electrical-part wearing system.
[0002]
[Description of the Prior Art] While having two or more feeders which arrange an electrical part (electronic parts are included) in one train, and are sent to a components feed zone and supplying an electrical part with these feeders, there is a system which picks out an electrical part from a feeder by the adsorption nozzle among the electrical-part wearing systems. Although two or more feeders are put in order and formed in the feed direction of an electrical part, and the right-angled direction and an adsorption nozzle takes out an electrical part from one of two or more feeders, if two or more adsorption nozzles are prepared and it is made to make an electrical part stick to the adsorption nozzle of these plurality simultaneously, it is possible to raise the supply efficiency of an electrical part. For example, while putting two or more adsorption nozzles in order in the direction of a feeder list and making it hold to one migration member, it is possible to double simultaneously the location of the integral multiple of the distance between each part article feed zones of two or more feeders, then a two or more adsorption nozzles and each part article feed zone of two or more feeders for the distance between the axes of each adsorption nozzle, and to make an electrical part adsorb simultaneously.
[0003]
[The technical problem, the technical-problem solution means, and effectiveness] which invention tends to solve However, it may be difficult to double simultaneously the location of two or more adsorption nozzles and two or more electrical parts. For example, the distance between the components feed zones of two or more feeders may not be unable to be restricted, and may be unable to double simultaneously with regularity the location of two or more electrical parts located in a components feed zone, and two or more adsorption nozzles. Moreover, according to the manufacture error of an adsorption nozzle or a feeder, an assembly error, etc., if an error is in the distance between the axes of two or more adsorption nozzles, and the distance between each part article feed zones of two or more feeders Even if a gap can arise in the location of the adsorption nozzle of every plurality, and a components feed zone, and an adsorption nozzle cannot adsorb an electrical part or it can adsorb, the location from which it separated from the core of an electrical part will be adsorbed, and stability is missing.
[0004] This invention makes the above situation a background, two or more adsorption nozzles are made considering offering the electrical-part supply approach, the electrical circuit manufacture approach, and electrical-part wearing system which are stabilized and can adsorb an electrical part simultaneous as a technical problem, and the electrical-part supply approach, the electrical circuit manufacture approach, and electrical-part wearing system of following each mode are obtained by this invention. Like a claim, each mode is classified into a term, gives a number to each item, and indicates it in the format of quoting the number of other terms if needed. This is for making an understanding of this invention easy to the last, and technical features and those combination given in this description should not be interpreted as being limited to each following item at the thing of a publication. Moreover, when two or more matters are indicated by the first term, the matter of these plurality must not always be adopted together. It is also possible to choose and adopt only some matters.
[0005] In addition, it sets in each following term, (1) term is equivalent to claim 1, (2) terms are to claim 2, (10) terms are equivalent to claim 4, and (12) terms are equivalent to claim 3 for (9) terms at claim 5, respectively.
[0006] The feeder which arranges an electrical part in one train and is sent to a components feed zone (1) Two or more While arranging and installing in the feed direction of these feeders, and the right-angled direction, the nozzle holder which holds an adsorption nozzle, respectively It is the approach of sticking to each of two or more adsorption nozzles which put in order in the direction of a list of said feeder, were made holding to one migration member, and were made holding to these nozzle holders with negative pressure, and making it taking out an electrical part from each of said feeder. At least by one side of adjusting the distance of said direction of a list between the shafts of some [at least] things of two or more of said adsorption nozzles, and adjusting the delivery halt location of said electrical part in each of two or more of said feeders Alignment of the electrical part supplied by two or more feeders and the thing of a part of at least two or more of said adsorption nozzles is performed, and it is these electrical-parts supply approach to which two or more electrical parts are made to stick to some adsorption nozzles simultaneously even if few. The distance of the direction of a list between shafts is good also as accommodation being possible about all of two or more adsorption nozzles, and good also as accommodation being possible about a part. The distance of the direction of a list between shafts is adjusted about all adsorption nozzles, and you may make it all adsorption nozzles adsorb an electrical part simultaneously, it adjusts about some adsorption nozzles, and you may make it some adsorption nozzles adsorb an electrical part simultaneously in the case of the former. It is some adsorption nozzles, the distance between shafts may be made to be adjusted about all of two or more adsorption nozzles that can adjust the distance of the direction of a list between shafts, and it may be made to be adjusted also in the latter about some adsorption nozzles. If the distance of the direction of a list between the shafts of two or more adsorption

nozzles is adjusted For example, whether the distance between the components feed zones of a feeder is not fixed or an error is in the distance between the axes of two or more adsorption nozzles, or the distance between the components feed zones of a feeder The location of two or more adsorption nozzles and two or more electronic parts is doubled, it can be stabilized and an electrical part can be made to stick to two or more adsorption nozzles simultaneous by adjusting the distance of the direction of a list between the shafts of two or more adsorption nozzles. Moreover, even if an error is in the delivery halt location of an electrical part or the position error of a direction parallel to a feed direction etc. is in an adsorption nozzle, the location in the feed direction of two or more adsorption nozzles and two or more electrical parts is doubled, respectively, it can be stabilized and an electrical part can be made to stick to two or more adsorption nozzles simultaneous by adjusting a delivery halt location, if the delivery halt location of the electrical part in each of two or more feeders is adjusted. Although adjusting either of the distance of the direction of a list and a delivery halt location can even raise adsorption precision, if both are adjusted, adsorption precision can improve more, for example, adsorption of a small electrical part can be stabilized more.

[0007] (2) Adjust the delivery halt location of an electrical part by using what sends an electrical part and adjusting the delivery halt location of a carrier tape by sending the carrier tape of the longitudinal configuration which puts in order and holds an electrical part in one train as said feeder to a longitudinal direction. The electrical-part supply approach given in (1) term. Opening of a components hold crevice could be closed by the covering tape stuck on the carrier tape, and a carrier tape may hold the lead of an electrical part, or may hold an electrical part in one train while many components hold crevices are established in one train along with the longitudinal direction of a carrier tape and one electrical part is held at a time in each part article hold crevice.

(3) (1) term which adjusts the wheel base of the adsorption section of some [said / at least] adsorption nozzles when the attaching part-ed held at said nozzle holder and the adsorption section which adsorbs an electrical part use what carried out eccentricity mutually and rotates a nozzle holder as said adsorption nozzle -- or -- The electrical-part supply approach given in (2) terms. By this paragraph "The distance in the direction of a list between the shafts of some [at least] things" in (1) term will be "a wheel base of the adsorption section of some [at least] adsorption nozzles." If an attaching part-ed and the adsorption section are made to carry out eccentricity mutually, a nozzle holder can be rotated, it can be made to be able to circle in the core of the adsorption section around axis of rotation of a nozzle holder, the location in the direction of a list of the feeder can be changed, and the distance in the direction of a feeder list between the shafts of two or more adsorption nozzles can be adjusted. For example, that a revolution position error (revolution position error of the circumference of an axis right-angled to the adsorbed field where it adsorbs by the adsorption nozzle of an electrical part) should be canceled to the electrical part which the adsorption nozzle held In what was constituted so that a nozzle holder might be rotated, an adsorption nozzle might be rotated and an electrical part might be rotated It is possible to adjust a wheel base using a holder slewing gear for that, and the wheel base of the adsorption section of an adsorption nozzle can be adjusted easily and cheaply.

[0008] (4) make some [at least] things of two or more of said nozzle holders hold possible [accommodation of a wheel base] to said migration member, and adjust the wheel base of some [said / at least] adsorption nozzles by accommodation of the wheel base of these nozzle holders (1) term -- or -- The electrical-part supply approach given in (2) terms.

[0009] (5) use what makes an electric motor a driving source as a feed gear which sends said electrical part, and adjust the delivery halt location of said electrical part by control of angle of rotation of the electric motor (1) term -- or -- The electrical-part supply approach given in either of the (4) terms. The feed gear which makes an electric motor a driving source is formed in two or more feeders, respectively, and the delivery halt location of an electrical part is adjusted for every feeder by control of angle of rotation of an electric motor. According to control of angle of rotation of an electric motor, the delivery halt location of an electrical part can be adjusted easily. The driving source slack electric motor of a feed gear may be formed out of a feeder, and the operation system section operated by the electric motor may be prepared in a feeder. You make the relative displacement of a driving source and two or more feeders carry out in the direction parallel to the direction of a list of a feeder in this case, may make it make it a driving source drive the thing of the arbitration of two or more feeders, each feed gear of two or more feeders is made to share a driving source, the regulatory mechanism of a delivery pitch is prepared in the operation system section, and you may make it adjust the delivery halt location of an electrical part.

[0010] (6) The location in a direction right-angled to said feed direction of each components feed zone of two or more of said feeders, The supply location detection stroke which detects at least one side with the delivery halt location of said electrical part in each feeder is included. Based on the supply location detected according to the supply location detection stroke, alignment of said electrical part and the thing of a part of at least two or more of said adsorption nozzles is performed. ** [there is no (1) term] The electrical-part supply approach given in either of the (5) terms. For example, it is possible to detect a supply location by making recognition equipment recognize the reference mark prepared near the components feed zone of a feeder, and the electrical part held at the carrier tape. Moreover, it is also possible by equipping each feeder with a gage tape and making recognition equipment recognize the gage tape to detect a supply location. A gage tape may be prepared apart from a carrier tape, and may be prepared in one with a carrier tape. The part which functions as a gage tape in the case of the latter (for example, the leader of a carrier tape) is prepared with proper means, such as printing and pasting of a seal. If the supply location of an electrical part is detected, even if a position error is in a supply location according to the manufacture error of a feeder, a position error, etc., alignment of two or more electrical parts and two or more adsorption nozzles will be performed so that it may be decreased, and the stability of adsorption will improve.

(7) performing the alignment of said electrical part and the thing of a part of at least two or more of said adsorption nozzles based on the adsorption section location which detected according to the adsorption section location detection stroke including the adsorption section location detection stroke which detects the location of the adsorption section which adsorbs the electrical part of some [at least] things of two or more of said adsorption nozzles (1) term -- or -- The electrical-part supply approach given in either of the (6) terms. If the location of the adsorption section of an adsorption nozzle is detected, even if a position error is in the location of the adsorption section, alignment of two or more electrical parts and two or more adsorption nozzles will be performed so that it may be decreased, and the stability of adsorption will improve.

[0011] (8) ** [there is no (1) term] The electrical circuit manufacture approach including the assembly stroke which assembles an electrical circuit by making two or more [on the circuit board / predetermined] equip either of the (7) terms with the electrical part made to hold for an adsorption nozzle by the electrical-part supply approach of a publication. Since two or more electrical parts are simultaneously picked out from a feeder, it is possible for the time amount which drawing of an electrical part takes to be short, to end, and to raise electrical circuit manufacture efficiency.
[0012] (9) Two or more feeders which compare an electrical part with the substrate supporting structure holding the circuit board in one train, and are sent to a components feed zone Each feed direction of these feeders becomes parallel to the first straight line on a base plane parallel to the front face of the circuit board held at said substrate supporting structure. Two or more adsorption nozzles in and the condition that they are located in a line in the direction parallel to said second straight line, with the feeder supporting structure held in the condition of standing in a line in the direction parallel to the second straight line on said base plane where the components feed zone of these feeders intersects the first straight line It holds pivotable around axis of rotation respectively right-angled to said base plane. And a migration member with self movable in the location of the arbitration of said base plane, The delivery halt centering-control equipment which adjusts the halt location of a direction parallel to said first straight line in said components feed zone of the electrical part in each of two or more of said feeders, By controlling at least at least one side and one side with the wheel base adjustment which adjusts the wheel base of a direction parallel to said second straight line of some [at least] things of two or more of said adsorption nozzles One [at least] relative position of a direction parallel to said first straight line with the electrical part supplied by some [said / at least] an adsorption nozzle and said two or more feeders and a direction parallel to said second straight line is adjusted. The electrical-part wearing system which contains in some [said / at least] adsorption nozzles the components receipt control unit which carry out adsorption maintenance of two or more electrical parts all at once. It is desirable for the first straight line and the second straight line to be what intersects perpendicularly mutually. While an electrical part is carried in the printed wired board by which the electrical part is not carried in all of the printed circuits prepared in the insulating substrate, the printed wired board by which the electrical part was already carried in some printed circuits, and a printed circuit, the printed circuit board which finished soldering junction and mounting to one field completed is contained in the circuit board. Two or more adsorption nozzles are moved to two or more feeders, and some [at least] adsorption nozzles take out two or more electrical parts all at once. One [at least] accommodation of the delivery halt location of an electrical part, and the wheel base of some [at least] things of two or more nozzles, It can be stabilized and an electrical part can be made to stick to two or more adsorption nozzles simultaneous, as explained in (1) term. Two or more feeders with which electrical parts are taken out all at once may adjoin mutually, and may be separated with two or more adsorption nozzles. Two or more adsorption nozzles holding two or more electrical parts are moved to the circuit board by the migration member, and equip the covering arrival location set as the circuit board with the held electrical part. While an adsorption nozzle is rotated before the circuit board is equipped with an electrical part, an electrical part is rotated, for example, the revolution position error of an electrical part is corrected, and if required, a position (revolution location) will be changed.
[0013] (10) It has the feed gear with which said feeder makes a driving source the electric motor which can control angle of rotation, and said delivery halt centering-control equipment contains the electric motor control unit which adjusts the delivery halt location of said electrical part by controlling the electric motor. Electrical-part wearing system given in (9) terms. A servo motor or a pulse motor is used as an electric motor. Accommodation of a driving source, then a delivery halt location is easy in the electric motor which can control angle of rotation.
(11) Said feeder was equipped with the tape-feed equipment which sends an electrical part by sending the carrier tape of the longitudinal configuration which puts in order and holds an electrical part in one train to a longitudinal direction. Electrical-part wearing system given in (9) terms or (10) terms.
[0014] (12) Said migration member holds two or more nozzle holders pivotable to the circumference of axis of rotation to which said base plane and some [at least] things of a list and the nozzle holder of these plurality cross at right angles respectively in the direction parallel to said second straight line, and said wheel base adjustment contains two or more these holder slewing gear with which arbitration can carry out the include-angle revolution of some nozzle holders according to an individual, even if few. Electrical-part wearing system given in either (9) terms thru/or (11) terms. An adsorption nozzle is rotated by rotating a nozzle holder. Therefore, if the adsorption section of an adsorption nozzle is made to carry out eccentricity to the attaching part-ed held by the nozzle holder, by rotating a nozzle holder, the adsorption section will be revolved by the surroundings of holder axis of rotation, the location to holder axis of rotation of the adsorption section will be adjusted, and the wheel base of two or more adsorption nozzles, i.e., the distance of the center to center of each adsorption section of two or more adsorption nozzles, will be adjusted. Intentional eccentricity is sufficient as the eccentricity to the attaching part-ed of the adsorption section, and the eccentric error resulting from the deflection of adsorption tubing which constitutes a manufacture error and the adsorption section etc. is sufficient as it. When adjusting a wheel base using an eccentric error and canceling a position error, eccentricity is insufficient, a position error all may be unable to be canceled, and a nozzle holder is rotated in that case to the location where a position error is most decreased by turning of the adsorption section.
[0015] (13) Said migration member holds two or more nozzle holders in the direction parallel to said second straight line in the condition movable in a list and the direction where some [at least] things of the nozzle holder of these plurality are parallel to the second straight line. Said wheel base adjustment moves some [the / at least] nozzle holders in the direction parallel to said second straight line. The holder migration equipment which adjusts the wheel base of some [the / at least] nozzle holders and the nozzle holder which adjoins it is included. Electrical-part wearing system given in either (9) terms thru/or (11) terms. According to this paragraph, even if it does not carry out eccentricity of the adsorption section and the attaching part-ed of an adsorption nozzle mutually, the distance of the center to center of the adsorption section can be adjusted, a wheel base can be adjusted, eccentricity of the adsorption section and the attaching part-ed of an adsorption nozzle is carried out, and a wheel base is adjusted by accommodation of a wheel base like [in the case of adjusting a wheel base by the revolution of a nozzle holder], without producing a gap of a direction parallel to the first straight line in the location of the adsorption section.

[0016] (14) The feed zone recognition equipment which recognizes near [each] the components feed zone of two or more of said feeders in the location defined beforehand, A location [in / based on the information from the feed zone recognition equipment / a direction right-angled to said feed direction of each components feed zone of two or more of said feeders], The supply reference-by-location profit equipment which acquires at least one side with the delivery halt location of said electrical part in each feeder is included. Said components receipt control unit adjusts one [said / at least] relative position based on the supply location acquired by the supply reference-by-location profit equipment. Electrical-part wearing system given in either (9) terms thru/or (13) terms. Feed zone recognition equipment is constituted by for example, image pick-up equipment. Image pick-up equipment is good also as field image pick-up equipment which acquires the secondary subject copy of a photographic subject at once, and a line sensor may constitute it. A line sensor has many the image sensors thru/or photo detectors arranged in in the shape of a straight line, and a secondary subject copy is obtained by picturizing repeatedly, carrying out relative displacement to a photographic subject. this paragraph -- for example, It is similarly explained as (6) terms. An operation given in (6) terms and effectiveness are acquired.
(15) The adsorption section recognition equipment which recognizes the adsorption section which adsorbs the electrical part of some [at least] things of two or more of said adsorption nozzles in the location defined beforehand, The adsorption section reference-by-location profit equipment which acquires the location of said adsorption section based on the information from the adsorption section recognition equipment is included. An electrical-part wearing system given in either (9) terms in which said components receipt control unit adjusts one [said / at least] relative position based on the adsorption section location acquired by the adsorption section reference-by-location profit equipment thru/or (14) terms. Adsorption section recognition equipment is constituted by for example, image pick-up equipment. according to this paragraph -- for example An operation given in (7) terms and effectiveness are acquired.
[0017]
[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained to a detail based on a drawing. The electronic-parts wearing system which is one of the operation gestalten of this invention is shown in drawing 1 . In drawing 1 , 10 is the base as a body of a system of an electronic-parts wearing system. On the base 10, the components feeder 24 and 26 grades which supply electronic parts 20 to the patchboard supporting structure 18 as the patchboard conveyer 16 which conveys the printed wired board 14 which is a kind of the circuit board, and the substrate supporting structure holding a printed wired board 14, the components wearing equipment 22 which equips a printed wired board 14 with the electronic parts 20 (refer to drawing 3) which are kinds of an electrical part, and components wearing equipment 22 are prepared.
[0018] The patchboard conveyer 16 is equipped with the guide rails 30 and 32 of a couple as roughly shown in drawing 1 . An endless wrapping object slack conveyor belt (graphic display abbreviation) is almost wound around the guide rails 30 and 32 of a couple, respectively, a printed wired board 14 is carried on a conveyor belt, and a printed wired board 14 is conveyed by making these one pairs of conveyor belts synchronize and go around with a belt driving gear (graphic display abbreviation).
[0019] It is held by the patchboard supporting structure 18 prepared in the part corresponding to the activity location of the base 12 while being stopped in the activity location defined beforehand in this operation gestalt by the arrester which a printed wired board 14 is conveyed with a level position by patchboard conveyer 16, and omits a graphic display. In this operation gestalt, a printed wired board 14 is held with a position with the level front face 28 (refer to drawing 2) which is a covering arrival side where it is equipped with the electronic parts 20, and is a top face.
[0020] In this electronic-parts wearing system, XY coordinate plane is horizontally set up about the whole. This XY coordinate plane constitutes a base plane parallel to the front face 28 of a printed wired board 14, on the other hand, biaxial [which intersects perpendicularly mutually on XY coordinate plane] comes out, a certain X-axis constitutes the second straight line on a base plane, and the Y-axis which is another side constitutes the first straight line on a base plane. In this operation gestalt, a printed wired board 14 is conveyed in the direction parallel to X shaft orientations by patchboard conveyer 16.
[0021] As shown in drawing 1 and drawing 2 , the components feeders 24 and 26 are mutually far apart in Y shaft orientations, fix a location to the both sides of the patchboard conveyer 16, and are stood still and prepared in them. The components feeders 24 and 26 are used as the feeder die-parts feeder by each in the example of a graphic display. The configuration of the components feeders 24 and 26 is the same, and explains the components feeder 24 typically. Moreover, the components feeders 24 and 26 are constituted by JP,10-112598,A almost like the components feeder of a publication, and are explained briefly.
[0022] The components feeder 24 has the components supply table 44 on which many feeders 40 were arranged on the feeder support table 42. By this operation gestalt, the feeder 40 shall be supplied in the condition of having made electronic parts 20 holding on the carrier tape 48, and having considered as the taping electronic parts 50, as shown in drawing 6 and drawing 7 .
[0023] the carrier tape 48 -- a longitudinal configuration -- accomplishing -- the direction where many components hold crevices 52 are parallel to a longitudinal direction -- setting -- regular intervals -- and, while being formed in one train By holding one electronic parts 20 at a time in each of the components hold crevice 52, and being closed with the covering tape 54 on which opening of these components hold crevice 52 was stuck on the carrier tape 48 The elutriation from the components hold crevice 52 of the electronic parts 20 in the time of a carrier tape feed etc. is prevented. The carrier tape 48 puts in order and holds electronic parts 20 in one train. The formation pitch of the components hold crevice 52 is called a components hold pitch thru/or a delivery pitch. Many sprocket holes 56 are established in the carrier tape 48 at equal intervals along with the longitudinal direction of the carrier tape 48 again. Thus, the constituted taping electronic parts 50 are set to a feeder 40 in the condition of having been twisted around the components hold machine slack components hold reel 58.
[0024] The carrier tape-feed equipment 66 and covering tape ** as the components hold machine supporting structure holding the body 62 of a feeder and the components hold reel 58 thru/or the tape supporting structure slack reel supporting structure 64, and tape-feed equipment carry out a feeder 40, and it has equipment 68. as shown in the body 62 of a feeder

at drawing 5 , while fitting is carried out to the engagement slot 72 which the positioning section 70 was formed and was established in the feeder support table 42 and the cross direction is positioned by parallel at X shaft orientations, it is made to engage with the engagement member 74 -- having -- positioning of a cross direction — and it comes floating, succeeds in prevention and is stopped by the feeder support table 42 removable by the engagement lever 76. In this operation gestalt, the feeder support table 42, the engagement slot 72, the engagement member 74, and the engagement lever 76 grade constitute the feeder supporting structure 78. The cross direction of a feeder 40 is a direction parallel to a longitudinal direction, and while two or more feeders 40 are positioned with the position in which a longitudinal direction becomes parallel to Y shaft orientations by the feeder supporting structure 78, each part article feed zone of two or more feeders 40 is held together with the straight line top parallel to X shaft orientations. In addition, in this operation gestalt, in order to simplify explanation, it is supposed that the maintenance pitch of the feeder 40 by the feeder supporting structure 78 is fixed, and suppose that the feeder 40 with large width of face is held using the tooth space for two or more pitches. A maintenance pitch is the distance in X shaft orientations of the location on the design of each part article feed zone which the adjoining feeder 40 mentions later.

[0025] The reel supporting structure 64 is equipped with the support roller 80 of revolution supporter material slack plurality attached in the body 62 of a feeder pivotable, and is supporting the components hold reel 58 pivotable. The taping electronic parts 50 pulled out from the components hold reel 58 are carried on the advice member 88 prepared in the body 62 of a feeder, and are sent to the front, i.e., the patchboard conveyer 16 side, by carrier tape-feed equipment 66 in the condition of having been supported from the lower part.

[0026] Carrier tape-feed equipment 66 is equipped with a pulse motor 100, the actuation gear 102, the driven gear 104 attached in the body 62 of a feeder pivotable, respectively, the driving pulley 106, the driving belt 108, the driven pulley 110, and the sprocket 112. The sprocket hole 56 of the taping electronic parts 50 is made to engage with the gear tooth 114 of a sprocket 112, by rotating a sprocket 112, it is sent in the direction parallel to Y shaft orientations, and the taping electronic parts 50 are the longitudinal direction thru/or the longitudinal direction of a feeder 40, and they are sent [electronic parts 20 are put in order by one train and] to a components feed zone. Electronic parts 20 are sent in the direction of a list of two or more feeders 40, and the right-angled direction. Moreover, the actuation gear 102 grade constitutes the revolution transport unit which transmits the revolution of a pulse motor 100 to a sprocket 112.

[0027] A pulse motor 100 is a kind of the electric motor slack revolution electric motor which can control angle of rotation, the driving source of carrier tape-feed equipment 66 is constituted, and angle of rotation of a pulse motor 100 is controlled by control of a driving signal. Thereby, the delivery die length of the taping electronic parts 50 is adjusted, and the delivery halt location of the taping electronic parts 50 thru/or electronic parts 20 is adjusted. Although the supply location of the electronic parts 20 of a feeder 40 is determined by the delivery halt location in Y shaft orientations, the delivery halt location is adjusted.

[0028] Covering 115 (refer to drawing 8) is put on the part made to engage with the sprocket 112 of the carrier tape 54, and the part before and behind that, the covering tape 54 removes and the relief from the body 62 of a feeder of the taping electronic parts 50 at the time is prevented. Opening 117 is formed and he is trying for drawing by the components wearing equipment 22 of electronic parts 20 to approve, as shown in covering 115 at drawing 8 . The part containing this opening 117 constitutes the components feed zone 122 of a feeder 40.

[0029] As shown in a sprocket 112 at drawing 9 , the detected part material 116 is formed in relative revolution impossible. The detected part material 116 accomplishes the cylinder top of an owner bottom, and the slit 120 is formed in the peripheral wall 118 at the equiangular distance. Let the pitch of the hoop direction of a slit 120 be the integral multiple of the formation pitch of the components hold crevice 52 of the taping electronic parts 50 sent by the feeder 40 by which this sprocket 112 was formed. The detected part material 116 is approached and the detection equipment slack photoelectrical sensor 124 is formed. The photoelectrical sensor 124 has a light-emitting part 126 and a light sensing portion 128, is used as the transparency mold in this operation gestalt, and a light-emitting part 126 and a light sensing portion 128 counter the both sides of a peripheral wall 118 mutually, respectively, and it is arranged. Therefore, when a sprocket 112 is rotated and the detected part material 116 is rotated with it, in the condition that a light-emitting part 126 and a light sensing portion 128 counter a slit 120, a light sensing portion 128 receives light, and a light sensing portion 128 does not receive light in the condition that parts other than slit 120 of a peripheral wall 118 counter. When it changes into the condition of receiving light from the condition that a light sensing portion 128 does not receive light and the light income exceeds the set point, the photoelectrical sensor 124 is constituted so that the detecting signal may change to ON signal from an OFF signal.

[0030] The photoelectrical sensor 124 is formed possible [accommodation of the location of the circumference of axis of rotation of a sprocket 112]. The location of the photoelectrical sensor 124 is beforehand adjusted in the location where a detecting signal changes from an OFF signal to ON signal exactly in the condition of being located in the supply location which the components hold crevice 52 of the taping electronic parts 50 is a location in the opening 117 of covering 115, and is a location where the components feed zone 122 was defined beforehand. This accommodation is performed by the operator. The components hold crevice 52 is the location located in the location where it was set up beforehand, for example, center, of opening, or this supply location is a location where the gear tooth 114 of a sprocket 112 will be in the condition of being located in the predetermined condition in the slot prepared in covering 115.

[0031] The slit 120 of the detected part material 116 is formed in the hoop direction in the pitch of the integral multiple of the components hold pitch of the taping electronic parts 50. For example, if there is no misfeed difference in carrier tape-feed equipment 66 when formed in the same pitch as 1 time, i.e., a components hold pitch In a pulse motor's 100 designing, when [at which it was set up] an include-angle revolution is carried out, the detecting signal of the photoelectrical sensor 124 changes from an OFF signal to ON signal with ********** with the taping electronic parts 50 equal to one pitch, i.e., a components hold pitch.

[0032] However, since it is not directly linked with a pulse motor 100 but the revolution of a pulse motor 100 is transmitted to a sprocket 112 through a revolution transport unit, an error produces a sprocket 112 in the revolution of a sprocket 112. The magnitude of this error is obtained from actual angle of rotation of the pulse motor 100 when the detecting signal of the

photoelectrical sensor 124 changes from an OFF signal to ON signal, and angle of rotation on a design. For example, thetaMN, then a misfeed difference are acquired by lengthening N-theta MU to include-angle thetaMN in angle of rotation of the pulse motor 100 when the detecting signal of N-theta MU and the photoelectrical sensor 124 changes angle of rotation on the design of the pulse motor 100 which delivery of one pitch of the taping electronic parts 50 takes to ON signal from an OFF signal. N is the count of delivery of the taping electronic parts 50. In addition, although the number of the pulses for operating a pulse motor 100 counts and angle of rotation is obtained with a pulse number, you may make it angle-of-rotation detection equipments, such as an encoder, detect angle of rotation of a pulse motor in this operation gestalt.

[0033] The example produced in the sense from which the misfeed difference of carrier tape-feed equipment 66 becomes superfluous [angle of rotation of a sprocket 112] is shown in drawing 10 . A misfeed difference is accumulated with buildup of the count N of delivery. Therefore, whenever the detecting signal of the photoelectrical sensor 124 changes from an OFF signal to ON signal, while a misfeed difference is searched for, the absolute value is compared with the set point. It is judged with its error being small with [difference / this misfeed difference is an accumulated error and] the set point [below], and it being convenient. It is reset, while an error will be large and the actuation command value of a pulse motor 100 will be corrected, if the set point is exceeded to it. For example, while an actuation command value is corrected so that angle of rotation of a part for an accumulated error and a pulse motor 100 may become small at the time of the next delivery of delivery of the taping electronic parts 50 at the time of it being detected that the absolute value of an accumulated error exceeded the set point, angle-of-rotation N-theta MU and thetaMN are reset by 0 at the time of the next delivery initiation. A misfeed difference accumulates without limits by that cause, and it is avoided that the positioning accuracy to the components feed zone of electronic parts 20 falls.

[0034] As said covering tape ** carries out and equipment 68 is shown in drawing 5 It has the driving belt 138 and the driven pulley 140 which ****** carries out and transmit the revolution of the driving pulley 106 of said carrier tape-feed equipment 66 to the pinch rollers 134 and 136 of one pair of member slack, and one pinch roller 134. While the covering tape 54 inserted elastically is sent between pinch rollers 134,136 by rotating a pinch roller 134 and rotating a pinch roller 136, it is removed from the carrier tape 48. Covering tape ** considers as carrier tape-feed equipment 66, equipment 68 is sharing the driving source, delivery of the taping electronic parts 50 and the covering tape 56 remove it, and ** is performed simultaneously. The covering tape 54 removed from the carrier tape 54 is pulled out outside from the slit 144 (refer to drawing 8) prepared in covering 115, and is discharged below through the advice member slack advice tubing 142. In addition, let carrier tape-feed equipment 66, the revolution wrapping object slack pulley which covering tape ** carries out and constitutes equipment 68, and the wrapping object slack belt be a timing pulley and a timing belt in this operation gestalt, respectively.

[0035] Components wearing equipment 22 is explained. Components wearing equipment 22 is equipped with the XY robot 152 which moves three components wearing units 150 and these components wearing unit 150 in plurality and this operation gestalt. With the XY robot 152, three components wearing units 150 are made to carry out straight-line migration to the location of the arbitration in said XY coordinate plane, convey electronic parts 20, and equip the front face 28 of a printed wired board 14 with them.

[0036] The XY robot 152 contains the Y-axis slide 160 formed movable on the base 10 at Y shaft orientations, the Y-axis slide migration equipment 162 to which the Y-axis slide 160 is moved, the X-axis slide 164 formed movable on the Y-axis slide at X shaft orientations, and the X-axis slide migration equipment 166 to which the X-axis slide 164 is moved, as shown in drawing 1 .

[0037] Y-axis slide migration equipment 162 makes a driving source the motor 168 for Y-axis slide migration. It is changed into the rectilinear motion of the Y-axis slide 160 by the motion inverter with which the revolution contains the nut 172 of immobilization in the feed screw slack ball screw 170 and the Y-axis slide 164 which were formed in parallel at Y shaft orientations. The Y-axis slide 160 is guided by the guide apparatus containing the advice member 174 of the shape of one pair of rail, and the shown around member 176 of the letter of a block, and is moved to Y shaft orientations. These ball screws 170 and the advice member 174 are formed above the patchboard conveyer 14 and the components feeders 24 and 26 by two or more columns 178 set up on the base 12. Headquarters article wearing equipment 22 is so-called ****** type equipment.

[0038] X-axis slide migration equipment 166 makes a driving source the motor 180 for X-axis slide migration, as shown in drawing 2 . With the motion inverter with which the revolution contains the nut 184 (refer to drawing 3) of immobilization in the feed screw slack ball screw 182 and the X-axis slide 164 which were formed [X shaft orientations] on the Y-axis slide 160 at parallel It is changed into the rectilinear motion of the X-axis slide 164, it shows around with the guide apparatus with which the X-axis slide 164 contains the rail-like advice member 186 and the shown around member 188 of the letter of a block, and is moved to X shaft orientations. The X-axis slide 164 is movable in the location of the arbitration in XY coordinate plane by being moved to X shaft orientations by X-axis slide migration equipment 166, and moving the Y-axis slide 160 to Y shaft orientations by Y-axis slide migration equipment 162, and the X-axis slide 164 constitutes the migration member in this operation gestalt. You may think that a migration member is prepared independently [the X-axis slide 164], and it is prepared in one with the X-axis slide 164.

[0039] Said three components wearing units 150 are formed in parallel together with the single tier at X shaft orientations on the X-axis slide 164. The configuration of these components wearing unit 150 is the same, and explains one typically. the holder migration equipment with which you make it move in the direction parallel to the perpendicular direction which is a direction right-angled to said level XY coordinate plane, and make it go up and down, and the components wearing unit 150 approaches a printed wired board 14, and makes it estrange the adsorption nozzle 200, a nozzle holder 202, and a nozzle holder 202 as shown in drawing 3 thru/or access, and alienation -- equipment -- the holder lifting device 204 and the holder slewing gear 206 made to rotate a nozzle holder 202 to the circumference of the vertical axis of rotation are included.

[0040] The holder lifting device 204 equips the X-axis slide 164 with the migration member slack rise-and-fall member 210 and the rise-and-fall member migration equipment 212 which were formed perpendicularly movable. Rise-and-fall member migration equipment 212 makes a driving source the motor 216 for rise and fall, and is transmitted to the feed screw slack ball screw 224 by the revolution transport unit in which the revolution contains a driving pulley 218, the driven pulley 220, and

a driving belt 222. While being prepared in shaft orientations at migration impossible, it is screwed in the nut 226 of immobilization in the rise-and-fall member 210, and the rise-and-fall member 210 is made to go up and down a ball screw 224 pivotable and by rotating a ball screw 224 to the X-axis slide 164 by the circumference of a vertical axis. Rise and fall of the rise-and-fall member 210 are guided by the guide apparatus which contains in the X-axis slide 164 the advice member (one is illustrated by drawing 3) 228 of the shape of one pair of rail established perpendicularly. In addition, a driving pulley 218 and the driven pulley 220 are constituted by the timing pulley, and the driving belt 222 is constituted by the timing belt.
[0041] Said nozzle holder 202 is formed in the rise-and-fall member 210 pivotable at the circumference of a vertical axis, holds the adsorption nozzle 200 removable, and it is rotated for it by rotating a nozzle holder 202 by the circumference of axis of rotation with the vertical adsorption nozzle 200. Moreover, a nozzle holder 202 is made to go up and down by making the rise-and-fall member 210 go up and down, and, thereby, the adsorption nozzle 200 is made to go up and down it. With this operation gestalt, the nozzle holder 202 is constituted by the patent No. 3093339 official report like the nozzle holder of a publication, for example, and omits a detailed graphic display and explanation. The part and nozzle holder 202 holding the nozzle holder 202 of the rise-and-fall member 210 constitute the wearing head.
[0042] Said holder slewing gear 206 is formed in the rise-and-fall member 210. The holder slewing gear 206 makes the motor 240 for a revolution a driving source, a revolution of the motor 240 for a holder revolution is transmitted to a nozzle holder 202 by the actuation gear 242 and the driven gear 244, and arbitration is made to carry out the include-angle revolution of it in forward reverse both directions by the circumference of the axis of self with a vertical nozzle holder 202.
[0043] Said adsorption nozzle 200 has the adsorption tubing 252 by which fitting was carried out to the nozzle body 250 and the nozzle body 250. A nozzle body 250 constitutes an attaching part-ed, and the adsorption tubing 252 constitutes the adsorption section and is held by the nozzle holder 202 in the nozzle body 250 at that relative displacement to shaft orientations is possible, and relative revolution impossible. Although the nozzle body 250 is held in the shape of a said alignment by the nozzle holder 202, fitting of the adsorption tubing 252 is carried out to the location which carried out eccentricity to the nozzle body 250, and it is made it to carry out eccentricity of the adsorption side 254 constituted by the apical surface of the adsorption tubing 252 to a nozzle body 250 and a nozzle holder 202 in this operation gestalt, as shown in drawing 4 .
[0044] If a nozzle holder 202 is rotated, the adsorption side 254 will be revolved by the surroundings of holder axis of rotation, and the location of the X-axis and Y shaft orientations will be changed. Therefore, by that cause The location of X shaft orientations over the supply location of the feeder 40 of the adsorption side 254 is changed, and the various position errors in X shaft orientations are corrected so that the distance of the center to center of the adsorption side 254 of the adjoining adsorption nozzle 200 may be adjusted and it may mention later.
[0045] the adsorption nozzle 200 should adsorb electronic parts 20 with negative pressure, and pass the path prepared in the nozzle holder 202 etc. -- it connects with the source of negative pressure, the source of positive pressure, and atmospheric air which omit a graphic display -- having -- **** -- electromagnetism -- by the change of a direction change-over valve gear (graphic display abbreviation), the adsorption tubing 252 is made alternatively open for free passage by the source of negative pressure, the source of positive pressure, and atmospheric air, adsorption maintenance is carried out and electronic parts 20 are released.
[0046] Moreover, the emitter slack luminescence plate 260 is formed in relative revolution impossible, and is arranged in the surroundings of the adsorption nozzle 200 by the driven gear 244. Disc-like is accomplished, fluorescent paint is applied to the underside, and the luminescence plate 260 constitutes the luminescence side 262 from an example of a graphic display.
[0047] In addition, in this operation gestalt, in order to simplify explanation, even if the class of three adsorption nozzles 200 is the same and the classes of electronic parts 20 supplied by two or more feeders 40 of the components feeders 24 and 26 differ, suppose the adsorption nozzle 200 that any electronic parts 20 of a class can be held.
[0048] Moreover, three components wearing units 150 are formed so that the pitch (pitch of the normal on a design) of a direction parallel to X shaft orientations between the axes of rotation of each nozzle holder 202 may serve as an integral multiple of the feeder maintenance pitch in the feeder support table 42.
[0049] As shown in drawing 3 , the reference mark image pick-up system 272 which picturizes the reference mark 270 (refer to drawing 1) prepared in the printed wired board 14 is formed in the X-axis slide 164 again. The reference mark 270 is formed in two pieces and the location which was far apart in the diagonal line of a printed wired board 14 in plurality and the example of a graphic display, respectively. The reference mark image pick-up system 272 is equipped with the image pick-up equipment slack reference mark camera 274 (refer to drawing 3) and the lighting system (graphic display abbreviation).
[0050] In this operation gestalt, the reference mark camera 274 is equipped with the image pick-up section which has CCD (charge-coupled device) which is a kind of solid-state image sensors, and the lens system containing an image formation lens, and let it be field image pick-up equipment which is a kind of the image pick-up equipment which acquires the secondary subject copy of a photographic subject at once with this operation gestalt. Many minute photo detectors are arranged on 1 flat surface, and CCD generates the electrical signal according to the light-receiving condition of each photo detector. The image pick-up field thru/or the image pick-up screen are formed of many photo detectors. The medial-axis line becomes vertical, and the reference mark camera 274 is formed with the downward position.
[0051] On said base 10, as shown in drawing 1 , the components image pick-up system 280 fixes a location, and is formed in the location between the patchboard conveyer 16 and the components feeders 24 and 26, respectively. The configuration of these components image pick-up system 280 is the same, and explains one side typically.
[0052] The components image pick-up system 280 is equipped with the image pick-up equipment slack components camera 282 and the lighting system (graphic display abbreviation). The components camera 282 is used as field image pick-up equipment while it is constituted from this operation gestalt by the CCD camera as well as said reference mark camera 274, and it is formed with the position in which the medial-axis line serves as facing up vertically. A lighting system approaches the components camera 282 and is formed, in this operation gestalt, it is constituted so that ultraviolet rays and a visible ray may be selectively emitted toward a photographic subject, and the components camera 282 picturizes the projection image or en face view of a photographic subject.

[0053] This electronic-parts wearing system is controlled by the control unit 300 shown in drawing 11 . However, drawing 11 takes out and shows the deep part of relation to this invention among these systems. A control unit 300 makes a computer 302 a subject, and the processing unit (it is written as PU) 304, a read-only memory (ROM) 306, random access memory (RAM) 308, input port 310, and an output port 312 are connected by the bus line. The image processing computer 316 which analyzes the data of the image picturized with said reference mark camera 274 and the components camera 282, said photoelectrical sensor 124, encoder 320 grade, and various detectors and computers are connected to input port 310.
[0054] Said pulse motor 100 grade and various actuators are connected to the output port 312 through the actuation circuit 324, respectively. A motor 168,180,216,240 constitutes a driving source, respectively and is constituted from this operation gestalt by the servo motor as a revolution electric motor which is a kind of the electric motor which can control angle of rotation. It may replace with a servo motor and a pulse motor may be used. Moreover, angle of rotation of the motor 168 grade for Y-axis slide actuation is detected by the encoder as angle-of-rotation detection equipment; respectively, and motor 180 grade is controlled based on the detection result. In drawing 11 , the encoder 320 formed about the motor 168 for Y-axis slide actuation is shown typically. The adsorption nozzle 200 is made to receive electronic parts 20 in RAM308 from the components feeders 24 and 26, and various programs, such as a program, data, etc. for detecting position errors, such as a program for assembling an electronic circuitry and an axis of rotation of a nozzle holder 202, etc. are made to memorize by making a printed wired board 14 equip.
[0055] Actuation of an electronic-parts wearing system is explained. In this electronic-parts wearing system, initiation of wearing to the printed wired board 14 of electronic parts 20 is preceded. The position error of each part article feed zone 122 of the position error of each axis of rotation (holder axis of rotation is called hereafter) of three nozzle holders 202, the eccentricity of each adsorption side 254 of three adsorption nozzles 200, and all the feeders 40 of the components feeders 24 and 26 is detected. A position error is canceled by utilization of the eccentricity of the adsorption side 254, and accommodation of the delivery halt location of electronic parts 20 at the time of the receipt of the electronic parts 20 by the adsorption nozzle 200. The location of the adsorption nozzle 200 and electronic parts 20 is put together, two or more electronic parts 20 are simultaneously stabilized by two or more adsorption nozzles 200, and it is made to adsorb.
[0056] The eccentricity to the position error of holder axis of rotation and holder axis of rotation of the adsorption side 254 is detected by picturizing the adsorption side 254 with the components camera 282, and the position error of the components feed zone 122 sets a gage tape to a feeder 40, and is detected by picturizing with the reference mark camera 274 so that it may mention later. Therefore, although three nozzle holders 202 and the reference mark camera 274 are moved by the XY robot 152 according to the mobile data set up beforehand, respectively, the adsorption side 254 is picturized and a gage tape is picturized at the time of detection In this operation gestalt, for the simplification in question, the location to the X-axis slide 164 (XY robot 152) of the reference mark camera 274 and the components camera 282 is adjusted beforehand, and an error is removed. While making it obtained in the condition of being located in the relative position set up beforehand, the alignment of the acquisition and the adsorption side 254, and electronic parts 20 of the position error of holder axis of rotation etc. is explained supposing the condition that the XY robot's 152 zero position error and the misfeed difference are removed.
[0057] Detection of the position error of holder axis of rotation is explained. In a nozzle holder 202, a position error arises according to a manufacture error, an error with a group, etc. at holder axis of rotation. At the time of detection of a position error, three nozzle holders 202 are moved to up to the components camera 282 one by one. The data for this migration are created, respectively about the location of the normal on three designs of each axis of rotation of a nozzle holder 202, and they are created so that holder axis of rotation may be in agreement with an image pick-up core.
[0058] At the time of position error detection of holder axis of rotation, the adsorption nozzle 200 is held at three nozzle holders 202, respectively, and the adsorption side 254 of the adsorption nozzle 200 is picturized with the components camera 282 in the condition that the adsorption nozzle 200 is located in plurality, for example, two revolution locations, respectively. Under the present circumstances, the en face view of the adsorption side 254 is picturized. A visible ray is irradiated from the lighting system of the components image pick-up system 280, and the adsorption side 254 is picturized based on the reflected light from the adsorption side 254.
[0059] Let another side be the location where the motor 240 for a holder revolution was located in the zero-point location with this operation gestalt, for example, and the nozzle holder 202 was made into the location at the time of being located in a zero-point location, and, as for one side of two revolution locations for an image pick-up, was far apart from the zero-point location 180 degrees. the zero-point location of the encoder which detects angle of rotation of the motor 240 for a holder revolution -- being mechanical (hard ---like) -- it is detected and the zero-point location of the motor 240 for a holder revolution is detected. The revolution location of the nozzle holder 202 at the time of the motor 240 for a holder revolution being located in a zero-point location is called a revolution Hara location.
[0060] If the adsorption side 254 is picturized in the condition that a nozzle holder 202 is located in one image pick-up location, a nozzle holder 202 will be rotated 180 degrees, and will be picturized in the image pick-up location of another side, and image pick-up data will be processed in an image processing computer 316. By the image pick-up in one image pick-up location, it sets on an image pick-up screen, and is drawing 12 (a). So that it may be shown The image of the appearance of the adsorption side 254 of the adsorption nozzle 200 is obtained, and by the image pick-up in the image pick-up location of another side Drawing 12 (b) Supposing the image of the appearance of the adsorption side 254 is obtained so that it may be shown these two images are formed in the location which was far apart 180 degrees -- having -- **** -- the coordinate of the central point of each image -- M1 (x1 and y1) and M2 -- then (x2 and y2) The mid gear of these two points is a location of the holder axis of rotation A, and the coordinate is [(x1+x2) /2, (y1+y2) / 2]. position error deltaXA to holder axis of rotation of the normal on the design of holder axis of rotation with the actual location to the image pick-up core of the holder axis of rotation A, and deltaYA it is -- it matches with the data (for example, attaching position data in the X-axis slide 164 of a nozzle holder 202) which specify a nozzle holder 202, and RAM308 memorizes. In addition, in this operation gestalt, in order to make an understanding easy, the same sign as the adsorption side 254 is attached and shown also about the image obtained by the image pick-up of the adsorption side 254.

[0061] Detection of the eccentricity of the adsorption side 254 is explained. Although eccentricity of the adsorption tubing 252 is intentionally carried out to a nozzle body 250 and the eccentricity is understood on the design, it does not restrict that actual eccentricity is the magnitude on a design, but exact eccentricity is acquired by the eccentric error resulting from the manufacture error of the adsorption tubing 252, an error with a group, the deflection of the adsorption tubing 252, etc. based on the image pick-up of the adsorption side 254.
[0062] Although two or more adsorption nozzles 200 from which a class is the same or differs in a nozzle holder 202 are held As opposed to the location of holder axis of rotation being the same even if the adsorption nozzles 200 held differ the location of the adsorption side 254 of the adsorption nozzle 200 It may change according to the class of adsorption nozzle 200, and whenever it is detached and attached by the nozzle holder 202 also with the same adsorption nozzle 200, it may change, and it is detected, whenever the adsorption nozzle 200 is held at a nozzle holder 202 and used for wearing of electronic parts 20.
[0063] If the adsorption nozzle 200 used for wearing of electronic parts 20 is held at a nozzle holder 202, a nozzle holder 202 will be moved to the components camera 282. Under the present circumstances, the mobile data created based on the location of the normal on the design of a holder axis of rotation is corrected based on the position error of the holder axis of rotation acquired previously, and a nozzle holder 202 is moved to the location whose holder axis of rotation corresponds with the image pick-up core of the components camera 282. At the time of an image pick-up, the nozzle holder 202 is located by the revolution Hara location, and the en face view of the adsorption side 254 is picturized with the components camera 282. And eccentric deltaXN [as opposed to the holder axis of rotation of the core of the adsorption side 254 in a location / as opposed to / the center position is called for and / the image pick-up core] and deltaYN if the image of the appearance of the adsorption side 254 was obtained as shown in drawing 13 It carries out, matches with the data (for example, data which specify the nozzle holder 202 holding the adsorption nozzle 200) which specify the adsorption nozzle 200, and RAM308 memorizes. Since the adsorption nozzle 200 is held by the nozzle holder 202 at relative revolution impossible, a nozzle holder 202 produces similarly the eccentricity of the adsorption side 254 where the adsorption nozzle 200 was held and detected by the nozzle holder 202 to holder axis of rotation in the condition of being located in a revolution Hara location. The eccentricity of the adsorption nozzle 200 is acquired, respectively about all of the adsorption nozzles 200 held at three nozzle holders 202, respectively.
[0064] Detection of the position error of the components feed zone 122 is explained. With this operation gestalt, the gage tape 350 shown in drawing 14 is used for detection of the position error of the components supply location 122. While the engagement hole 352 which has the same configuration as the sprocket hole 56 formed in the carrier tape 48 of said taping electronic parts 50 and a dimension is formed in the same pitch as the formation pitch of a sprocket hole 56 along with the longitudinal direction of plurality and the gage tape 350, the reference mark 354 which has the same configuration as the cross-section configuration of the components hold crevice 52 and a dimension is formed in the gage tape 350 in the pitch of the integral multiple of the formation pitch of the components hold crevice 52. Also in the tape longitudinal direction, i.e., a direction parallel to the feed direction of electronic parts 20, the relative position of the engagement hole 352 and a reference mark 354 is made with sufficient dimensional accuracy also in the direction which intersects perpendicularly with the cross direction, i.e., a feed direction, and is made with a precision sufficient to the same relative position as the relative position of the normal of the sprocket hole 56 of the taping electronic parts 50, and the components hold crevice 52. Moreover, the reference mark 354 of the gage tape 350 and parts other than reference mark 354 are carried out if an optical property, for example, a color, brightness, or lightness is **, and the large image of contrast is obtained about a reference mark 354 and parts other than reference mark 354 of the gage tape 350, the image of a reference mark 354 is obtained clearly, and he is trying to be obtained with a precision sufficient [the location]. For example, it is carried out if both color is **, and it is supposed that the gage tape 350 is white and a reference mark 354 is made black.
[0065] The gage tape 350 is set about each of each feeders 40 of two or more of two components feeders 24 and 26. The engagement hole 352 is made to engage with the gear tooth 114 of a sprocket 112, a sprocket 112 is rotated, the gage tape 350 is stopped in the location where the detecting signal of delivery and the photoelectrical sensor 124 changes from an OFF signal to ON signal, and the adsorption side 354 is located in the components feed zone 122. If covering 115 may be put on the gage tape 350 and the image pick-up of a reference mark 354 is not barred, it is not necessary to put it. It is formed with a sufficient precision so that it may be located in the relative position as the relative position of the normal of the components hold crevice 52 of the taping electronic parts 50, and a sprocket hole 56 where the reference mark 354 and the engagement hole 352 of the gage tape 350 are the same, and a reference mark 354 is located by the components feed zone 122 like the components hold crevice 52 which supplies electronic parts 20, and is positioned with a sufficient precision to a sprocket 112. In addition, if the tape-ized electronic parts 50 are already set to the feeder 40 when setting the gage tape 350 from a feeder 40, it will be removed from a sprocket 112 at least.
[0066] After the set of the gage tape 350, the reference mark camera 274 is made to carry out sequential migration to each part article feed zone 122 of two or more feeders 40, and picturizes a reference mark 354. The mobile data of the reference mark camera 274 at the time of an image pick-up is created about the image pick-up core, and it is created so that the reference mark camera 274 may move to the supply location of the normal on the design to which the image pick-up core which is a core of an image pick-up screen was set about all the feeders 40, respectively, and a location in agreement. And in an image processing computer 316, the image processing of the image pick-up data is carried out, the location to the image pick-up core of the core of a reference mark 354 is detected, and the location of a reference mark 354 is acquired. The center position of a reference mark 354 is a actual supply location in a feeder 40, the location of X shaft orientations of a reference mark 354 is a location in a direction right-angled to the electronic-parts feed direction of the components feed zone 122 of a feeder 40, and the location of Y shaft orientations of a reference mark 354 is a delivery halt location of the electronic parts 20 in a feeder 40. position error deltaXF to the supply location on the design of the supply location where the gap to the image pick-up core of the center position of a reference mark 354 is actual if the actual supply location has shifted to the image pick-up core at least in one side of X shaft orientations and Y shaft orientations, and deltaYF it is -- it matches with the data (for example, attaching position data to the feeder support table 42 of a feeder 40) which specify a

feeder 40, and it is memorized by RAM308. The gage tape 350 is made with sufficient dimensional accuracy, and the bow of the error of carrier tape-feed equipment 66, the locational error of a feeder 40, a manufacture error, and the body 62 of a feeder etc. is included in the position error acquired based on the image pick-up of a reference mark 354.
[0067] Wearing of the electronic parts 20 to a printed wired board 14 is started after detection of the above-mentioned position error and eccentricity. In addition, they are position error deltaXP and deltaYP about each of two or more covering arrival locations set as the front face 28 while the reference mark 270 was picturized with the reference mark camera 274 and the maintenance position error of the printed wired board 14 by the patchboard supporting structure 18 was detected, whenever the printed wired board 14 was carried in and it was held by the patchboard supporting structure 18. An operation is asked for a twist.
[0068] In this electronic-parts wearing system 10, at the time of wearing of electronic parts 20, at least one of three adsorption nozzles 200 adsorbs and equips with electronic parts 20, and in case two or more adsorption nozzles 200 adsorb electronic parts 20, it adsorbs simultaneously. The case where three adsorption nozzles 200 adsorb electronic parts 20 simultaneously is explained.
[0069] The pitch on three designs of X shaft orientations of each axis of rotation of a nozzle holder 202 is made into the integral multiple of the maintenance pitch of the normal of the feeder 40 in the feeder support table 42, and three adsorption nozzles 200 are three feeders 40 with which it was planned that the pitch between supply locations is in agreement with the pitch of a holder axis of rotation among two or more feeders 40, and pick out electronic parts 20 from the feeder 40 which supplies electronic parts 20 to the adsorption nozzle 200. As shown in drawing 15 , in each actual supply location of three feeders 40 which supply electronic parts 20 to three adsorption nozzles 200, respectively There are position errors delta XF1, delta XF2, and delta XF3 of X shaft orientations and position errors delta YF1, delta YF2, and delta YF3 of Y shaft orientations. It is supposed that there are position errors delta XA1, delta XA2, and delta XA3 of X shaft orientations and position errors delta YA1, delta YA2, and delta YA3 of Y shaft orientations at each holder axis of rotation of three nozzle holders 202, respectively. The location of two or more electronic parts 20 and the adsorption side 254 of the adsorption nozzle 200 is explained that the eccentricity of each adsorption side 254 of three adsorption nozzles 200 is delta XN1, delta XN2, delta XN3, delta YN1, delta YN2, and delta YN3. In addition, although the adsorption side 254 is picturized from a lower part with the components camera 282, in order to simplify explanation, in drawing 15 and drawing 16 , the eccentricity of the adsorption side 254 and the position error of holder axis of rotation are converted into the position error and eccentricity in the condition of having seen the adsorption side 254 from the top, and are shown. Moreover, the above-mentioned position error and eccentricity attach the sign of positive/negative, and are acquired, and these forward negative direction presupposes that it is the same as the forward negative direction of XY coordinate plane set up in the whole electronic-parts wearing system. Suppose that the upper part is the forward direction of Y shaft orientations, and the method of the right is the forward direction of X shaft orientations in drawing 15 and drawing 16 . Furthermore, in drawing 15 and drawing 16 , a position error and eccentricity are exaggerated and illustrated, in order to give explanation easy.
[0070] 3 sets of components wearing units 150 are carried on the common X-axis slide 164, and are moved by the XY robot 152 in one in each direction of the X-axis and a Y-axis. Therefore, the mobile data within the level surface of the X-axis slide 164 at the time of a components receipt is created about one of three nozzle holders 202. For example, suppose that mobile data is created so that the central nozzle holder 202 may be moved to the location whose supply location and holder axis of rotation of normal on the design of the feeder 40 which supplies electronic parts 20 to the adsorption nozzle 200 which the nozzle holder 202 holds correspond about holder axis of rotation of the normal on the design of the nozzle holder 202 of the central components wearing unit 150.
[0071] First and the mobile data of the X-axis slide 164 It is corrected based on the position errors delta XF2 and delta YF2 of the components supply location of the feeder 40 with which electronic parts 20 are taken out by the adsorption nozzle 200 which the position errors delta XA2 and delta YA2 of axis of rotation of the central nozzle holder 202 and the nozzle holder 202 of those hold. The X-axis slide 164 is drawing 16 (a). It is moved to the location actual axis of rotation of the central nozzle holder 202 and whose actual supply location correspond so that it may be shown.
[0072] In this condition, there is a gap in each adsorption side 254 of three adsorption nozzles 200, and each actual supply location of three feeders 40, and if electronic parts 20 were stopped by the actual supply location, a location gap will arise in electronic parts 20 and the adsorption side 254. This location gap rotates the adsorption nozzle 200 in X shaft orientations. The distance of the center to center of the adsorption side 254 of the adsorption nozzle 200 held at the adjoining nozzle holder 202, That is, it is canceled by adjusting the wheel base of the adsorption nozzle 200, and is canceled by adjusting the delivery halt location of the electronic parts 20 by carrier tape-feed equipment 66 in Y shaft orientations, and the location of electronic parts 20 and the adsorption side 254 is put together. If eccentricity of the adsorption side 254 is carried out to holder axis of rotation, a nozzle holder 202 is rotated and the adsorption nozzle 200 is rotated Although the adsorption side 254 is revolved by the surroundings of holder axis of rotation and changed [in / on X shaft orientations or / in the receipt location of the electronic parts 20 by the adsorption nozzle 200 / Y shaft orientations] It is because the taping electronic parts 50 are moved only to Y shaft orientations and a supply location is adjusted only in a components feed direction.
[0073] Angle of rotation and the hand of cut of a nozzle holder 202 for the alignment in X shaft orientations are set up about the nozzle holder 202 in the condition of being located in a revolution Hara location. A nozzle holder 202 is set up considering the condition of being located in a revolution Hara location, as 0 times. This angle of rotation and hand of cut are called for based on the location (eccentricity) of the core of the adsorption side 254 over holder axis of rotation in the condition that a nozzle holder 202 is located in a revolution Hara location, and the location of X shaft orientations over the actual supply location of the core of the adsorption side 254, supposing XY coordinate plane which makes holder axis of rotation a zero. As the arrow head of a broken line shows to drawing 16 (a), the adsorption side 254 is moved, and it is drawing 16 (b). Angle of rotation and a hand of cut are called for so that it may be shown, and a supply location and the core of the adsorption side 254 may be made in agreement in X shaft orientations.
[0074] In this operation gestalt, the revolution location of the nozzle holder 202 for wheel base accommodation may not be limited, but which location is sufficient as it 360 degrees. Therefore, X coordinate value of a location [on XY coordinate plane

top which carried out / above-mentioned / the assumption and as opposed to holder axis of rotation (origin of coordinates) of the adsorption side 254], It is based on the location of X shaft orientations over the actual supply location of the core of the adsorption side 254 in the condition that axis of rotation of the central nozzle holder 202 was made in agreement with a actual supply location. Although X coordinate value on XY coordinate plane which carried out [above-mentioned] the assumption in the actual supply location is calculated, it passes along the X coordinate value, distance of a straight line parallel to a Y-axis, and the core of the adsorption side 254 and holder axis of rotation is made into a TR and an intersection with the turning locus centering on origin of coordinates is called for The two intersection is called for. Two locations at the time of the core of the adsorption side 254 being in agreement with a actual supply location in X shaft orientations are obtained. Therefore, from the center position of the adsorption side 254 in the condition that a nozzle holder 202 is located in a revolution Hara location, angle of rotation taken to reach two acquired locations is called for in forward reverse both directions, respectively, and it is adopted as angle of rotation and the hand of cut for the wheel base accommodation for a location gap dissolution of the hand of cut where there are little angle of rotation and angle of rotation of the smaller one of them, and they end.

[0075] About the adsorption nozzle 200 of the central components wearing unit 150, the location of X shaft orientations over the actual supply location of the core of the adsorption side 254 is obtained by location deltaXN2 of X shaft orientations to holder axis of rotation of the core of the adsorption side 254.

[0076] About the adsorption nozzle 200 of the components wearing unit 150 on either side The location of X shaft orientations over the actual supply location of the core of the adsorption side 254 If the left-hand side adsorption nozzle 200 is taken for an example in drawing 15 and drawing 16 , in addition to delta XA1, delta XN1, and delta XF1, it will be obtained based on the amount of corrections of the mobile data based on delta XA2 and delta XF2 for doubling the axis of rotation of the central nozzle holder 202 with a actual supply location. The same is said of the right-hand side adsorption nozzle 200.

[0077] In case a nozzle holder 202 is returned to a revolution Hara location and then receives electronic parts 20 after it equips a printed wired board 14 with the electronic parts 20 which the adsorption nozzle 200 held, according to angle of rotation and the hand of cut which were called for for alignment, the holder slewing gear 206 is operated to it, and it is rotated by the nozzle holder 202. The distance of the center to center of the adsorption side 254 which the adsorption side 254 is revolved by that cause, and adjoins is adjusted, and it is moved in the direction shown in drawing 16 (a) by the arrow head of a broken line in X shaft orientations, and as shown in drawing 16 (b), the core and supply location of the adsorption side 254 are united with X shaft orientations, i.e., an electronic-parts feed direction, in a right-angled direction. A location gap is canceled, the position error of X shaft orientations, such as a actual supply location, is canceled, and the location of the components feed zone 122 thru/or electronic parts 20, and the adsorption side 254 is together put in X shaft orientations.

[0078] The eccentricity (it is the distance of holder axis of rotation and the core of the adsorption side 254, and is the TR of the adsorption side 254) of the adsorption side 254 is beforehand determined in consideration of the position error of X shaft orientations which should be canceled. The greatest position error in X shaft orientations expected in holder axis of rotation and the supply location of a feeder 40, respectively is the magnitude which it can cancel simultaneously even if positive/negative arises conversely, and eccentricity is set as the magnitude more than the sum of each absolute value of the greatest position error produced to hard flow.

[0079] Accommodation of the delivery halt location of the taping electronic parts 50 for canceling the location gap in Y shaft orientations of the core of the adsorption side 254 and a actual supply location is performed by controlling the driving signal of a pulse motor 100. As a line crack and this centering control show drawing 16 (b) that accommodation of a delivery halt location makes the core of the adsorption side 254, and a actual supply location in agreement in Y shaft orientations with an alternate long and short dash line, it is carried out based on the location of Y shaft orientations over the actual supply location of the core of the adsorption side 254 in the condition that the location in X shaft orientations was put together.

[0080] The location of Y shaft orientations over the actual supply location of the core of the adsorption side 254 Location deltaYN [as opposed to / nozzle / 200 / central / adsorption / holder axis of rotation of the core of the adsorption side 254]2 of Y shaft orientations, It is obtained based on a location gap of Y shaft orientations of the adsorption side 254 produced by turning of the adsorption side 254 for the alignment of X shaft orientations of the core of the adsorption side 254 and a actual supply location. The driving signal of a pulse motor 100 is set up so that this location gap may be canceled and the core of the adsorption side 254 and a actual supply location may be in agreement in Y shaft orientations, and angle of rotation of a pulse motor 100 is increased or decreased. As the delivery die length of the taping electronic parts 50 is made for a long time or short by that cause as compared with the case where there is no location gap, the delivery halt location of electronic parts 20 is adjusted and it is shown in drawing 16 (c), electronic parts 20 are stopped for a actual supply location by the location suiting [a location's with the adsorption side 254], and the location of the adsorption side 254 and the adsorption nozzle 200 is put together.

[0081] About the adsorption nozzle 200 of right-and-left both sides, the location of Y shaft orientations over the actual supply location of the core of the adsorption side 254, respectively If the left-hand side adsorption nozzle 200 is taken for an example, it will add to delta YA1, delta YN1, and delta YF1. It is obtained based on a location gap of Y shaft orientations produced in order to double the core and supply location of the amount of corrections of mobile data and the adsorption side 254 based on delta YA2 and delta YF2 for doubling the axis of rotation of the central nozzle holder 202 with a components supply location in X shaft orientations. And as a location gap is canceled, the delivery halt location of the taping electronic parts 50 is adjusted so that the core of the adsorption side 254 and a actual supply location may be together put in Y shaft orientations, and shown in drawing 16 (c), the core of the adsorption side 254 and a actual supply location are put together, and the location of the adsorption side 254 and electronic parts 20 is put together. The same is said of the right-hand side adsorption nozzle 200.

[0082] As mentioned above, for the alignment of X shaft orientations of the adsorption side 254 and a actual supply location, although a nozzle holder 202 is rotated in the direction where angle of rotation ends at least With this operation gestalt, when both location is together put in X shaft orientations, the adsorption side 254 does not separate from opening 117, but the

location gap in the components feed direction of the core of the adsorption side 254 and a actual supply location may be canceled by accommodation of the delivery halt location of electronic parts 20. Make it in addition, better [to rotate to the direction where the location gap in the components feed direction of the core of not only rotating a nozzle holder 202 in the direction where angle of rotation is small and ends depending on the convenience of opening 117 grade but the adsorption side 254, and a actual supply location becomes small] in some cases.

[0083] Although the eccentric error of the adsorption side 254 by a manufacture error etc. is also contained in the eccentricity of the adsorption side 254 detected by the image pick-up, the eccentric error will also be canceled by doubling the core of the adsorption side 254, and a actual supply location as mentioned above.

[0084] Thus, where the location of the electronic parts 20 and the adsorption side 254 of three adsorption nozzles 200 which are supplied by three feeders 40 is put together, three adsorption nozzles 200 are simultaneously dropped all at once by the holder lifting device 204, respectively, and electronic parts 20 are simultaneously adsorbed all at once with negative pressure. Both location is together put also in Y shaft orientations also in X shaft orientations by accommodation of the wheel base which is the distance of the center to center of the adsorption side 254, and accommodation of the delivery halt location of electronic parts 20, and three adsorption nozzles 200 adsorb electronic parts 20 simultaneously, without producing a reception mistake etc.

[0085] In addition, by accommodation of the delivery halt location of the taping electronic parts 20, detection of the misfeed difference of the above-mentioned carrier tape-feed equipment 66 and correction are similarly made, when alignment of the electronic-parts feed direction of the adsorption side 254 and the components feed zone 122 is performed.

[0086] The position error and eccentricity which were acquired as mentioned above RAM308 memorizes as each characteristic value of a nozzle holder 202, the adsorption nozzle 200, and a feeder 40. The adsorption nozzle 200, It responds to combination with the feeder 40 which supplies electronic parts 20 to the adsorption nozzle 200. The eccentricity of the position error of holder axis of rotation and the adsorption side 254 and the position error of a actual supply location should combine. Correction of the travel of the X-axis slide 164, accommodation of a wheel base, and accommodation of a components delivery halt location are performed, and the location of the adsorption side 254 of two or more adsorption nozzles 200 and electronic parts 20 is put together. Although the adsorption nozzle 200 receives electronic parts 20 in order of wearing to a printed wired board 14 in principle, since it receives electronic parts 20 in different sequence from the order of wearing like [in case it generates, and an adsorption mistake wedges the electronic parts 20 with which it was not equipped in order of wearing set up beforehand and equips with them for example,], its adsorption nozzle 200 which receives electronic parts 20 to the same feeder 40 is not necessarily the same. Therefore, if the combination of the feeder 40 which supplies electronic parts 20, and the adsorption nozzle 200 which receives electronic parts 20 from a feeder 40 is decided Reading appearance of the position error of the position error of the supply location of the feeder 40 beforehand detected about each, the eccentricity of the adsorption side 254, and axis of rotation holding the adsorption nozzle 200 of a nozzle holder 202 is carried out from RAM308. Correction of the travel of the X-axis slide 164, turning of the adsorption side 254 by the revolution of the adsorption nozzle 200, accommodation of the delivery halt location of the taping electronic parts 50, etc. are performed, and it is stabilized simultaneously and made for the electronic parts 20 of plurality [nozzles / 200 / two or more / adsorption] to be adsorbed.

[0087] Three adsorption nozzles 200 are raised after adsorption of electronic parts 20, and electronic parts 20 are picked out from a feeder 40. And if the location of the circumference of the position of electronic parts 20, i.e., an axis, is changed in the time of adsorption and wearing, while a nozzle holder 202 will be rotated and electronic parts 20 will be rotated, it is moved to up to the components camera 282.

[0088] The position error is corrected, a nozzle holder 202 is moved, and electronic parts 20 are picturized with the components camera 282 in the condition that holder axis of rotation and an image pick-up core were made in agreement. The mobile data of the nozzle holder 202 for picturizing electronic parts 20 is created, respectively about the axis of rotation of the normal on each three design of a nozzle holder 202, each mobile data is corrected based on the position error of the axis of rotation of a nozzle holder 202, a nozzle holder 202 is moved, a holder axis of rotation and an image pick-up core are made in agreement, and three electronic parts [one] 20 are picturized at a time in order of.

[0089] And the image processing of the image data obtained by the image pick-up is carried out, it is compared with the image data of normal without error, and a maintenance position error calculates about each of three electronic parts 20. Position error deltaXE [as opposed to a center position error i.e., holder axis of rotation of the core of electronic parts 20, in a maintenance position error], and deltaYE And revolution position error (position error of circumference of axis right-angled to adsorbed field where it adsorbs by adsorption nozzle 200 of electronic parts 20) deltatheta is contained.

[0090] After an image pick-up, the components wearing unit 150 is moved to up to a printed wired board 14, and three electronic parts 20 are moved to up to the covering arrival location defined beforehand one by one, and it is equipped with it. Wearing of the electronic parts 20 by three components wearing units 150 is performed according to an individual, and it is equipped with one electronic parts 20 at a time. One by one, although three electronic parts 20 are moved to a covering arrival location and it is equipped with them The mobile data at the time of electronic-parts wearing is created, respectively about the location of the location of the normal on three designs of holder axis of rotation of each nozzle holder 202 of the components wearing unit 150. Position error deltaXA whose mobile data is holder axis of rotation, deltaYA, center position error deltaXE of electronic parts 20, deltaYE, position error deltaXP of a covering arrival location, and deltaYP And it is corrected based on a center position gap of the electronic parts 20 produced by correction of revolution position error deltatheta. These position errors are canceled. While electronic parts 20 being moved to a covering arrival location, the adsorption nozzle 200 is rotated, revolution position error deltatheta of electronic parts 20 is corrected, the covering arrival location of normal is equipped with electronic parts 20 with the position of normal, and assembly of an electronic circuitry is performed.

[0091] If three adsorption nozzles 200 equip a printed wired board 14 with electronic parts 20, it will be moved to the components feeder 24 or 26 for the receipt of the following electronic parts 20. Under the present circumstances, a nozzle holder 202 is returned to a revolution Hara location. and at the time of the receipt of electronic parts 20, various position

errors, such as holder axis of rotation, should be corrected, and the core of the adsorption side 254 and a actual supply location be put together -- the location of the adsorption side 254 and electronic parts 20 unites -- having -- the electronic parts 20 of plurality [nozzles / 200 / two or more / adsorption] -- simultaneous -- a location gap -- it is few, and it is stabilized and is made to adsorb

[0092] In this operation gestalt, the X-axis slide 164 constitutes a migration member, and the pulse motor 100 of a control unit 300 is controlled, and the part which adjusts the delivery halt location of the taping electronic parts 50 constitutes an electric motor control unit, and constitutes delivery halt centering-control equipment so that clearly from the above explanation. Moreover, three holder slewing gears 206 made to rotate three nozzle holders 202 according to an individual constitute the wheel base adjustment which adjusts the wheel base which is the distance of a direction parallel to X shaft orientations of the center to center of the adsorption side 254 of three adsorption nozzles 200. Moreover, the reference mark camera 274 constitutes feed zone recognition equipment, and constitutes the supply reference-by-location profit equipment with which an image processing computer 316 acquires the location in a direction right-angled to the feed direction of the electronic parts 20 of the components feed zone 122, and the delivery halt location of electronic parts 20 based on the image data obtained by the image pick-up of the gage tape 350 with the reference mark camera 274. The components camera 282 constitutes adsorption section recognition equipment, and the part from which an image processing computer 316 acquires the eccentricity of the adsorption side 254 based on the image data obtained by the image pick-up of the adsorption side 254 with the components camera 282 constitutes adsorption section reference-by-location profit equipment. Furthermore, based on the location acquired by the supply reference-by-location profit equipment and adsorption section reference-by-location profit equipment of a control unit 300, a pulse motor 100 and the motor 240 for a revolution are controlled. The relative position of a direction respectively parallel to X shaft orientations and Y shaft orientations of each adsorption side 254 of two or more adsorption nozzles 200 and two or more electronic parts 20 supplied by two or more feeders 40 is adjusted. Where the location of two or more adsorption sides 254 and electronic parts 20 is doubled, the part which carry out adsorption maintenance of two or more electronic parts 20 all at once constitutes the components receipt control unit for the adsorption nozzle 200.

[0093] Each adsorption section of three adsorption nozzles 200 is made to carry out eccentricity to an attaching part-ed in the above-mentioned operation gestalt. The wheel base of the adsorption nozzle 200 Although the adsorption nozzle 200 is rotated, it is adjusted by making it circle in the adsorption side 254 and it is made to be carried out in the alignment of a right-angled direction in the components feed direction of electronic parts 20 and the adsorption nozzle 200 by that cause The wheel base of an adsorption nozzle is adjusted, a position error is corrected, and you may make it double a location by moving two or more nozzle holders in the direction right-angled to a components feed direction, respectively. The operation gestalt is explained based on drawing 17 thru/or drawing 19 . In addition, the same sign is given to the component which succeeds in the same operation as the component of the above-mentioned operation gestalt, response relation is shown, and explanation is omitted.

[0094] In the electronic-parts wearing system of this operation gestalt, 3 sets of components wearing units 400 are held together with the direction parallel to X shaft orientations at the migration member slack X-axis slide 164 which constitutes the XY robot 152 in plurality and this operation gestalt. Among these 3 sets of components wearing units 400, the central components wearing unit 400 fixes a location to the X-axis slide 164, and is held, and the components wearing unit 400 of right-and-left both sides is formed in the direction parallel to X shaft orientations movable.

[0095] 3 sets of components wearing units 400 are constituted like said components wearing unit 150 except for 2 sets of components wearing units 400 being moved to X shaft orientations to the X-axis slide 164 and the central components wearing unit 400, and the wheel base of a nozzle holder 202 being adjusted. The components wearing unit 400 is equipped with the body 404 of a unit, and the adsorption nozzle 430, the nozzle holder 202, the holder lifting device 204, and the holder slewing-gear 206 grade are prepared in the body 404 of a unit. In the shown around member slack guide block 406 by which the central components wearing unit 400 was fixed to the X-axis slide 164 in the body 404 of a unit, and the components wearing unit 400 of both sides was formed in the body 404 of a unit Fitting is carried out to the advice member slack guide rail 408 prepared in parallel at X shaft orientations at the X-axis slide 164 movable. These guide block 406 and a guide rail 408 constitute the guide apparatus 410. Moreover, in the adsorption nozzle 430, the adsorption tubing 432 is held to this alignment at a nozzle body 434, and it is planned that the core of the adsorption side 436 is located on holder axis of rotation. The adsorption section of the adsorption nozzle 430 is prepared in the attaching part-ed and this alignment.

[0096] As shown in drawing 19 , while two nuts 414 are formed in revolution impossible and shaft orientations with a position parallel to X shaft orientations at migration impossible, the feed screw slack ball screw 416 is screwed in the body 404 of a unit of the central components wearing unit 400, respectively. These two ball screws 416 are rotated by the motor 418 for wheel base accommodation formed in the body 404 of a unit of the components wearing unit 400 of right-and-left both sides, respectively. In this operation gestalt, the motor 418 for wheel base accommodation is constituted by the servo motor, constitutes the driving source, fix to the body 404 of a unit and it is formed, and a ball screw 416 is unmovable to shaft orientations, although the revolution is possible to the body 404 of a unit with which the motor 418 for wheel base accommodation was formed. Therefore, if a ball screw 416 is rotated by the motor 418 for wheel base accommodation The components wearing unit 400 with which the motor 418 for wheel base accommodation was formed is guided at a guide apparatus 410, and is moved to X shaft orientations. The nozzle holder 202 of the components wearing unit 400 is moved to X shaft orientations. A wheel base with the nozzle holder 202 of the central components wearing unit 400 is adjusted, it is the wheel base of the adsorption nozzle 430, i.e., the distance between holder axis of rotation of a nozzle holder 202, and the distance of the center to center of the adsorption side 436 of the adsorption nozzle 430 is adjusted. In this operation gestalt, a ball screw 416, a nut 414, and the motor 418 grade for wheel base accommodation constitute holder migration equipment 420, and constitute the wheel base adjustment. Angle of rotation of the motor 418 for wheel base accommodation is detected by the encoder 422, and is inputted into the computer of the control unit which omits a graphic display.

[0097] In this operation gestalt, the position error of holder axis of rotation, the center position error of the adsorption side 436, and the position error of the supply location of a feeder are similarly detected in advance of initiation of wearing to the

printed wired board 14 of electronic parts 20 also in said operation gestalt. In this operation gestalt, since the adsorption tubing 432 is held to this alignment at the nozzle body 434, the gap to holder axis of rotation of the core of the adsorption side 436 is a position error produced based on a manufacture error etc.

[0098] In said operation gestalt, similarly, three components wearing units 400 are moved to a components camera, and detection of the position error of holder axis of rotation is detected by picturizing the adsorption side 436 of the adsorption nozzle 430 in two revolution locations. Under the present circumstances, the components wearing unit 400 of right-and-left both sides is located to the X-axis slide 164 by the original location beforehand set up in X shaft orientations. The pitch in X shaft orientations of the holder axis of rotation of three components wearing units 400 is a pitch set up beforehand, and a original location is a location used as the integral multiple of the maintenance pitch of the normal of a feeder, and is obtained with the detection value of the encoder 422 which detects angle of rotation of the motor 418 for wheel base accommodation. Moreover, the image pick-up of the adsorption side 436 is performed in two revolution locations with the revolution location where the nozzle holder 202 was far apart 180 degrees from the revolution Hara location and the revolution Hara location. A nozzle holder 202 holds the adsorption nozzle 430, the adsorption side 436 is picturized in the condition of being located in a revolution Hara location, and the center position error of the adsorption side 436 of the adsorption nozzle 430 is acquired based on the image pick-up data. The gap to holder axis of rotation of the core of the adsorption side 436 is acquired as a position error.

[0099] And although each location in the X-axis of the core of the adsorption side 436 of every plurality and a supply location and Y shaft orientations is put together, respectively and the location of two or more adsorption sides 436 and electronic parts 20 is together put when two or more adsorption nozzles 200 pick out electronic parts 20 from a feeder simultaneously The core of the adsorption side 254 of the adsorption nozzle 200 is made in agreement [in X shaft orientations] with a supply location about the central components wearing unit 400 also in Y shaft orientations by control of migration of the XY robot 152. The mobile data of the XY robot's 152 X-axis slide 164 and the Y-axis slide 160 About the location of the normal on the design of holder axis of rotation of the central components wearing unit 400 Are created so that it may be in agreement in a supply location, the X-axis, and Y shaft orientations, and the mobile data is corrected based on holder axis of rotation, the adsorption side 254 and X shafts each of a supply location, and the position error of Y shaft orientations, and the X-axis slide 164 and the Y-axis slide 160 are moved. The location of the adsorption side 254 and electronic parts 20 is together put also in Y shaft orientations also in X shaft orientations. Under the present circumstances, a nozzle holder 202 is located by the revolution Hara location.

[0100] About the adsorption nozzle 200 of the components wearing unit 400 on either side It adds to the position error of X shaft orientations each of the supply location of a feeder, holder axis of rotation, and the adsorption side 436. It is based on the amount of position error corrections in X shaft orientations for doubling the central core and central supply location of the adsorption side 436 of the components wearing unit 400. A nozzle holder 202 is moved by holder migration equipment 420 so that the location in X shaft orientations of the core of the adsorption side 436 and a supply location may suit. Distance with the axis of the nozzle holder 202 of the central components wearing unit 400 is adjusted, and the core of the adsorption side 436 and a actual supply location are together put in X shaft orientations. The movement magnitude and the migration direction of a nozzle holder 202 of [for this accommodation] are set up in the condition that a nozzle holder 202 is located in a revolution Hara location, and is located in a original location in X shaft orientations. A nozzle holder 202 is returned to a original location in X shaft orientations after the receipt of the electronic parts from a components feeder in advance of the image pick-up of electronic parts. Moreover, also in a hand of cut, it is returned to a original location after wearing of electronic parts, in case electronic parts are received, also in a hand of cut, it is in a original location also in X shaft orientations, and based on the movement magnitude and the direction which were set up in the original location and revolution Hara location of X shaft orientations, the location in X shaft orientations of a nozzle holder 202 is adjusted, and the wheel base of a nozzle holder 202 is adjusted.

[0101] About the components wearing unit 400 on either side, alignment of Y shaft orientations of the adsorption side 436 and a supply location is performed by accommodation of the delivery halt location of electronic parts 20. Based on the amount of corrections of the mobile data for doubling the location of Y shaft orientations of holder axis of rotation, the adsorption side 436 and the position error in Y shaft orientations each of a actual supply location, and the core of the adsorption side 436 of the adsorption nozzle 430 of the central components wearing unit 400 and a actual supply location, a delivery halt location is adjusted so that the core and the supply location of the adsorption side 436 may be in agreement in Y shaft orientations. Thus, while a wheel base is adjusted by migration of a nozzle holder 202, after accommodation of a components delivery halt location has accomplished, three adsorption nozzles 430 are dropped, and electronic parts are adsorbed all at once simultaneously.

[0102] After adsorption of electronic parts, while the adsorption nozzle 430 is raised, the nozzle holder 202 on either side is returned to a original location in X shaft orientations. And in said operation gestalt, one electronic parts are picturized at a time, a center position error, a revolution position error, etc. are corrected, and one printed wired board is similarly equipped at a time. Thus, accommodation is performed, without producing a location gap of Y shaft orientations in the adsorption side 436 by the accommodation, when moving a nozzle holder 202 to X shaft orientations, adjusting a wheel base and performing alignment of the adsorption nozzle 200 and electronic parts.

[0103] In each above-mentioned operation gestalt, although the location in a direction right-angled to the components feed direction of the components feed zone 122 and the delivery halt location of the electronic parts 20 in a feeder 40 were detected using the gage tape 350, they are not indispensable. [of using a gage tape] For example, you may make it acquire the position error of a actual supply location by forming a reference mark 440 in the covering 115 put on taping electronic parts, and picturizing the reference mark 440 with the reference mark camera 274, as shown in drawing 20 . The reference mark 440 is formed near the opening 117 of covering 115. As various configurations can be adopted, for example, it is shown in drawing 20 , a cross-joint form is sufficient, or even if a reference mark 440 is circular, it may be good, and polygons, such as rectangles, such as a triangle, a square, or a rectangle, are sufficient as it. A reference mark 440 may be formed by printing, may be prepared by pasting of a seal, and may be prepared by preparing heights or a crevice. Anyway, to the part in

which the reference mark 440 of covering 115 was formed, a reference mark 440 is carried out, if an optical property is **, and it is prepared so that a distinguishable image may be clearly formed at the time of the image pick-up with the reference mark camera 274.

[0104] At the time of the image pick-up of a reference mark 440, the reference mark camera 274 is moved according to the mobile data set up beforehand. It is created so that this mobile data of that image pick-up core may correspond with the location of the normal on the design of the core of a reference mark 440 as for the reference mark camera 274, and the image processing of the image data obtained by the image pick-up of a reference mark 440 is carried out, and the position error over the image pick-up core of the core of the image of a reference mark 440 is searched for. This position error is an error over the location of the normal of a reference mark 440. Since a reference mark 440 is formed near the opening 117 and prepared near the components feed zone 122, it is considered that it is the position error of the supply location where the position error of a reference mark 440 is actual. In addition, what is necessary is just to prepare a reference mark in the body of a feeder, if covering is not put on taping electronic parts.

[0105] The position errors of a supply location are the electronic parts 20 held at the taping electronic parts 50, and you may make it detect them by picturizing the electronic parts 20 moved to the supply location. It has a clearance and electronic parts 20 are held in the components hold crevice 52, although it is small. Therefore, as it does not restrict that it is fixed but is shown in drawing 21 , as for the location in the components hold crevice 52 of electronic parts 20, changing with electronic parts 20 is common. In addition, in drawing 21 , a clearance exaggerates and is illustrated.

[0106] Therefore, at the time of detection of the location of the components feed zone 122, two or more electronic parts 20 are picturized with the reference mark camera 274. The reference mark camera 274 is moved to the location whose supply location and image pick-up core of normal on a design correspond based on the mobile data set up beforehand, and picturizes the electronic parts 20 located in the components feed zone 122. Whenever electronic parts 20 are picturized, one pitch of taping electronic parts 50 is sent at a time, and two or more electronic parts 20 are picturized. And while the image processing of each image data of two or more electronic parts 20 is carried out and each position error in the X-axis of the core and image pick-up core and a Y-axis is searched for, the average of each position error of two or more electronic parts 20 is calculated, and it considers as the position error of a actual supply location. It is considered that the mean place of each center position of two or more picturized electronic parts 20 is a actual supply location, and it is made into the position error of the supply location where the average of a position error is actual.

[0107] Correction of the misfeed difference of the taping electronic parts 50 may be made to be made whenever the taping electronic parts 50 are sent once (a part for one pitch) in carrier tape-feed equipment 66. for example, a larger include-angle revolution than angle of rotation to which the revolution of a sprocket 112 was set to the revolution of a pulse motor 100 — carrying out — drawing 22 (a) So that it may be shown In a pulse motor's 100 designing, before [which carries out an angle-of-rotation thetaMU revolution] being set up, the detecting signal of the photoelectrical sensor 124 changes to ON signal from an OFF signal. When the delivery die length of the taping electronic parts 50 becomes longer than one pitch and the next delivery of electronic parts 50 is performed, delivery is performed using angle-of-rotation thetaMS of the pulse motor 100 when the detecting signal of the photoelectrical sensor 124 changes to ON signal from an OFF signal as 0. moreover, an include-angle revolution smaller than angle of rotation to which the revolution of a sprocket 112 was set to the revolution of a pulse motor 100 -- carrying out — drawing 22 (b) So that it may be shown In a pulse motor's 100 designing, after [which carried out the angle-of-rotation thetaMU revolution] being set up, the detecting signal of the photoelectrical sensor 124 changes to ON signal from an OFF signal. When the delivery die length of the taping electronic parts 50 becomes shorter than one pitch When the next delivery of electronic parts 50 is performed, after a pulse motor 100 is started, delivery is performed using angle-of-rotation thetaMS of the pulse motor 100 when the detecting signal of the photoelectrical sensor 124 changes to ON signal from an OFF signal as 0.

[0108] In said operation gestalt, although a location gap of Y shaft orientations of the adsorption side 254 produced with the dissolution is corrected by accommodation of a components delivery halt location and he was trying to be canceled when rotate the adsorption nozzle 200, making it circle in the adsorption side 254 to the circumference of holder axis of rotation and canceling a location gap, canceling is not indispensable. For example, if a location gap of Y shaft orientations of the adsorption side 254 by turning is small, it may be necessary to cancel.

[0109] In this case, as shown in drawing 23 , the correctable amount**w and the adsorption side 254 of the position error in X shaft orientations according to turning of the adsorption side 254 first pass along holder axis of rotation, and the amount L of location gaps of the adsorption side 254 where being generated in Y shaft orientations is permitted is determined by circling in order to correct the correctable amount**w from the condition on a straight line parallel to a Y-axis. And TR R required in order to realize the correctable amount**w within the amount L of allowance location gaps calculates. When the position error of the same quantity of X shaft orientations is corrected, a location gap of the adsorption side 254 produced in Y shaft orientations is so small that TR R is large, and ends, and, generally it is desirable to be selected so that TR R may become 3 times of the amount L of allowance location gaps in Y shaft orientations, 5 times, or 10 or more times.

[0110] In addition, in each above-mentioned operation gestalt, although he was trying to be detected in advance of initiation of wearing of electronic parts, the location of holder axis of rotation, an adsorption side, and a components feed zone a series of wearing — on the way -- eccentricity the time of the adsorption side being made to carry out eccentricity — may also be made to adjust accommodation of the wheel base of an adsorption nozzle, and the delivery halt location of electronic parts based on the position error which came out, it was, detected when the detection conditions set up beforehand were satisfied, and was newly detected. Detection conditions are that the setup time has passed since initiation of wearing for example, that wearing of the electronic parts to the printed wired board of setting-out number of sheets was performed, that the number of supplies of the electronic parts by one feeder reached the number of setting out, etc.

[0111] Moreover, in each above-mentioned operation gestalt, although the maintenance pitch of the feeder by the feeder supporting structure is fixed, two or more kinds may be changed. Let two or more kinds of maintenance pitches be the magnitude of the integral multiple of the minimum maintenance pitch.

[0112] Furthermore, when the adsorption section of an adsorption nozzle is made to carry out eccentricity to an attaching

part, it sets in the revolution Hara location of the nozzle holder detected mechanically. Although he was trying for angle of rotation and the direction of a nozzle holder of [for canceling a location gap of X shaft orientations of an adsorption side and a supply location and doubling a location] to ask An adsorption nozzle is made to hold to a nozzle holder, the value of the encoder in the condition of being located in the location where adsorption tubing was beforehand set up to holder axis of rotation is memorized, and it is good also considering the location as a revolution Hara location of a nozzle holder.

[0113] Moreover, when carrying out eccentricity of the adsorption section to an attaching part-ed about all of two or more adsorption nozzles and adjusting a wheel base by turning of an adsorption side, the travel of a migration member is not corrected at the time of the receipt of electronic parts, but you may make it double the location of two or more adsorption nozzles and two or more electronic parts similarly about all adsorption nozzles by accommodation of the wheel base by turning of an adsorption side, and accommodation of a components delivery halt location.

[0114] furthermore, the case where carry out eccentricity of the adsorption section of an adsorption nozzle to an attaching part-ed, and a wheel base is adjusted by turning of an adsorption side — two or more adsorption nozzles — the adsorption section and an attaching part-ed use one as the adsorption nozzle of this alignment, and the core and the supply location of an adsorption side may be made to put by correction of the movement magnitude to a supply location together about the adsorption nozzle.

[0115] Moreover, when carrying out eccentricity of the adsorption section of an adsorption nozzle intentionally to an attaching part-ed, eccentricity of the adsorption side 254 may be carried out to a nozzle body 250 as in said operation gestalt, and eccentricity of the nozzle holder may be carried out to the axis of rotation.

[0116] Moreover, when moving a nozzle holder in the direction parallel to the second straight line and adjusting the wheel base of a nozzle holder, holder migration equipment is good also as equipment not only containing equipment but the rack and pinion containing a ball screw and a nut, or good also as equipment including a link mechanism and a cam mechanism.

[0117] As mentioned above, although some operation gestalten of this invention were explained to the detail, it cannot pass over these to instantiation, but this invention can be carried out with the gestalt which performed various modification and amelioration based on the information of these contractors including the mode indicated by the term of the above [the technical problem which invention tends to solve, a technical-problem solution means, and effectiveness].

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the top view showing roughly the electronic-parts wearing system which is the operation gestalt of this invention.
[Drawing 2] It is the side elevation showing the above-mentioned electronic-parts wearing system.
[Drawing 3] It is the front view (part cross section) showing the components wearing equipment of the above-mentioned electronic-parts wearing system.
[Drawing 4] It is the bottom view showing the adsorption nozzle of the above-mentioned components wearing equipment.
[Drawing 5] The feeder which constitutes the components feeder of the above-mentioned electronic-parts wearing system is the front view (part cross section) showing the condition of having been held at the feeder support table.
[Drawing 6] It is the top view showing the taping electronic parts set to the above-mentioned feeder.
[Drawing 7] It is the side-face sectional view showing the above-mentioned taping electronic parts.
[Drawing 8] It is the top view showing covering put on taping electronic parts in the above-mentioned feeder.
[Drawing 9] It is the side-face sectional view showing the sprocket of the tape-feed equipment of the above-mentioned feeder.
[Drawing 10] It is a graph explaining the error produced at the time of delivery of the taping electronic parts by the above-mentioned tape-feed equipment, and its correction.
[Drawing 11] It is the block diagram showing the deep part of relation in this invention among the control devices which control the above-mentioned electronic-parts wearing system.
[Drawing 12] It is drawing explaining detection of the location of axis of rotation holding the above-mentioned adsorption nozzle of a nozzle holder.
[Drawing 13] It is drawing explaining detection of a location gap of the adsorption side of the above-mentioned adsorption nozzle.
[Drawing 14] It is the top view showing the gage tape used for detection of the position error of the components feed zone of the above-mentioned feeder.
[Drawing 15] It is drawing showing a location gap of the position error of the components feed zone of the above-mentioned feeder, the position error of holder axis of rotation, and an adsorption side.
[Drawing 16] It is drawing explaining correction of the position error at the time of adsorption of the electronic parts by the above-mentioned adsorption nozzle etc.
[Drawing 17] It is the side elevation showing the components wearing equipment of the electronic-parts wearing system which is another operation gestalt of this invention.
[Drawing 18] It is the front view (part cross section) showing the components wearing equipment shown in drawing 17 .
[Drawing 19] It is the top view showing the components wearing equipment shown in drawing 17 .
[Drawing 20] It is drawing explaining another operation gestalt of detection of the position error of the components feed zone of a feeder.
[Drawing 21] It is drawing explaining another operation gestalt of detection of the position error of the components feed zone of a feeder.
[Drawing 22] It is drawing explaining another operation gestalt of correction of the misfeed difference of the taping electronic parts by the carrier tape-feed equipment of a feeder.
[Drawing 23] It is drawing which explains setting out of the eccentricity of an adsorption side when the dissolution of a location gap of Y shaft orientations by turning is unnecessary at the time of accommodation of the wheel base by turning of the adsorption side of an adsorption nozzle.
[Description of Notations]
14: Printed wired board 18: Patchboard supporting structure 20: Electronic parts 22: Components wearing equipment 24 26: Components feeder 40: Feeder 48: Carrier tape 50: Taping electronic parts 66: Carrier tape-feed equipment
100: Pulse motor 150: Components wearing unit 152:XY robot 164: X-axis slide 200: Adsorption nozzle 202: Nozzle holder 206: Holder slewing gear 254: Adsorption side 274: Reference mark camera 282: Components camera 300: Control device 350: Gage tape
400: Components wearing unit 420: Holder migration equipment 430: Adsorption nozzle
432: Adsorption tubing 436: Adsorption side

[Translation done.]

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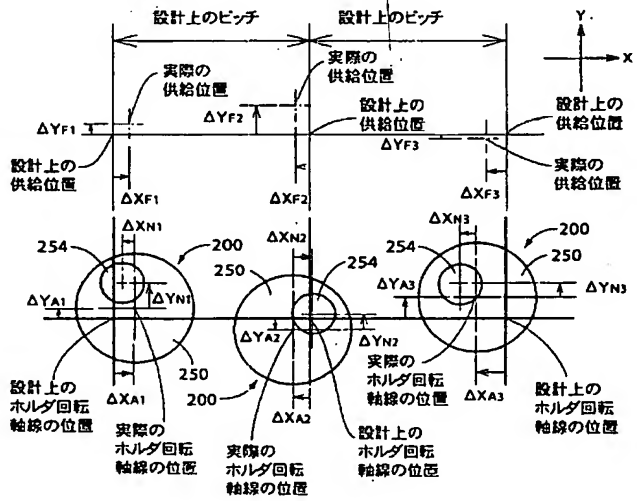
(54)【発明の名称】　電気部品供給方法および電気部品装着システム

(57)【要約】
【課題】　複数の吸着ノズルに電気部品を同時にかつ安定して吸着させる。
【解決手段】　吸着管とノズル本体とが偏心した複数の吸着ノズル２００をＸＹロボットのＸ軸スライドにＸ軸方向に並べて設ける。複数のフィーダにセットしたゲージテープ，吸着面２５４の撮像により供給位置の位置誤差，吸着面２５４の偏心，ホルダ回転軸線の位置誤差を取得し、電子部品２０の受取り時には、ノズルホルダを回転させ、吸着面２５４を旋回させて３個の吸着面２５４の中心間距離を調節し、Ｘ軸方向において電子部品との位置を合わせ、電子部品の送り停止位置の調節によりＹ軸方向において電子部品との位置を合わせ、３個の吸着ノズル２００に電子部品を同時にかつ安定して吸着させる。ノズルホルダのＸ軸方向の移動によりその軸間距離を調節し、吸着面２５４と電子部品とのＸ軸方向の位置を合わせるようにしてもよい。



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【特許請求の範囲】

【請求項１】　電気部品を１列に並べて部品供給部へ送るフィーダを複数個、それらフィーダの送り方向と直角な方向に並べて設置する一方、それぞれ吸着ノズルを保持するノズルホルダを、前記フィーダの並び方向に並べて１つの移動部材に保持させ、それらノズルホルダに保持させた複数の吸着ノズルの各々に前記フィーダの各々から電気部品を負圧により吸着して取り出させる方法であって、

前記複数の吸着ノズルの少なくとも一部のものの軸間の前記並び方向の距離を調節することと、前記複数のフィーダの各々における前記電気部品の送り停止位置を調節することとの少なくとも一方により、複数のフィーダにより供給される電気部品と複数の吸着ノズルの前記少なくとも一部のものとの位置合わせを行い、それら少なくとも一部の吸着ノズルに複数の電気部品を同時に吸着させることを特徴とする電気部品供給方法。

【請求項２】　前記フィーダとして、電気部品を１列に並べて保持する長手形状のキャリヤテープを長手方向に送ることによって電気部品を送るものを使用し、キャリヤテープの送り停止位置を調節することにより、電気部品の送り停止位置を調節することを特徴とする請求項１に記載の電気部品供給方法。

【請求項３】　回路基板を保持する基板保持装置と、

電気部品を１列に並べて部品供給部へ送る複数のフィーダを、それらフィーダの各々の送り方向が前記基板保持装置に保持された回路基板の表面に平行な基準平面上の第一直線に平行となり、かつ、それらフィーダの部品供給部が第一直線と交差する前記基準平面上の第二直線に平行な方向に並ぶ状態で保持するフィーダ保持装置と、

複数の吸着ノズルを、それらが前記第二直線に平行な方向に並ぶ状態で、かつ、それぞれ前記基準平面に直角な回転軸線のまわりに回転可能に保持し、自身は前記基準平面の任意の位置に移動可能な移動部材と、

前記複数のフィーダの各々における電気部品の前記部品供給部における前記第一直線に平行な方向の停止位置を調節する送り停止位置調節装置と、前記複数の吸着ノズルの少なくとも一部のものの前記第二直線に平行な方向の軸間距離を調節する軸間距離調節装置との少なくとも一方と、

その少なくとも一方を制御することにより、前記少なくとも一部の吸着ノズルと前記複数のフィーダにより供給される電気部品との前記第一直線に平行な方向と前記第二直線に平行な方向との少なくとも一方の相対位置を調節し、前記少なくとも一部の吸着ノズルに複数の電気部品を一斉に吸着保持させる部品受取制御装置とを含むことを特徴とする電気部品装着システム。

【請求項４】　前記フィーダが、回転角度の制御が可能な電動モータを駆動源とする送り装置を備え、前記送り停止位置調節装置が、その電動モータを制御することにより前記電気部品の送り停止位置を調節する電動モータ制御装置を含むことを特徴とする請求項３に記載の電気部品装着システム。

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【請求項５】　前記移動部材が、複数のノズルホルダを前記第二直線に平行な方向に並びかつそれら複数のノズルホルダの少なくとも一部のものが各々前記基準平面と直交する回転軸線まわりに回転可能に保持しており、前記軸間距離調節装置が、それら少なくとも一部のノズルホルダを個別に任意の角度回転させ得る複数のホルダ回転装置を含むことを特徴とする請求項３または４に記載の電気部品装着システム。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、電気部品供給方法および電気部品装着システムに関するものであり、特に、フィーダにより供給される電気部品の受取り精度の向上に関するものである。

【０００２】

【従来の技術】電気部品装着システムには、電気部品（電子部品を含む）を１列に並べて部品供給部へ送るフィーダを複数個備え、それらフィーダによって電気部品を供給するとともに、吸着ノズルによって電気部品をフィーダから取り出すシステムがある。複数のフィーダは、電気部品の送り方向と直角な方向に並べて設けられ、吸着ノズルは複数のフィーダのうちの１つから電気部品を取り出すのであるが、吸着ノズルを複数設け、それら複数の吸着ノズルに同時に電気部品を吸着させるようにすれば、電気部品の供給能率を向上させることが可能である。例えば、複数の吸着ノズルをフィーダ並び方向に並べて１つの移動部材に保持させるとともに、各吸着ノズルの軸線間の距離を、複数のフィーダの各部品供給部間の距離の整数倍とすれば、複数の吸着ノズルと複数のフィーダの各部品供給部との位置を同時に合わせ、電気部品を同時に吸着させることが可能なのである。

【０００３】

【発明が解決しようとする課題，課題解決手段および効果】しかしながら、複数の吸着ノズルと複数の電気部品との位置を同時に合わせることが困難な場合がある。例えば、複数のフィーダの部品供給部間の距離は一定とは限らず、部品供給部に位置する複数の電気部品と複数の吸着ノズルとの位置を同時に合わせることができない場合があるのである。また、吸着ノズルやフィーダの製造誤差，組立誤差等により、複数の吸着ノズルの軸線間の距離や、複数のフィーダの各部品供給部間の距離に誤差があれば、複数ずつの吸着ノズルと部品供給部との位置にずれが生じ、吸着ノズルが電気部品を吸着することができず、あるいは吸着することができても電気部品の中心から外れた位置を吸着することとなって安定性に欠ける。

【０００４】本発明は、以上の事情を背景とし、複数の

吸着ノズルが電気部品を同時にかつ安定して吸着し得る電気部品供給方法，電気回路製造方法および電気部品装着システムを提供することを課題としてなされたものであり、本発明によって、下記各態様の電気部品供給方法，電気回路製造方法および電気部品装着システムが得られる。各態様は請求項と同様に、項に区分し、各項に番号を付し、必要に応じて他の項の番号を引用する形式で記載する。これは、あくまでも本発明の理解を容易にするためであり、本明細書に記載の技術的特徴およびそれらの組合わせが以下の各項に記載のものに限定されると解釈されるべきではない。また、一つの項に複数の事項が記載されている場合、それら複数の事項を常に一緒に採用しなければならないわけではない。一部の事項のみを選択して採用することも可能なのである。

【０００５】なお、以下の各項において、(1)項が請求項１に相当し、(2)項が請求項２に、(9)項が請求項３に、(10)項が請求項４に、(12)項が請求項５にそれぞれ相当する。

【０００６】（１）電気部品を１列に並べて部品供給部へ送るフィーダを複数個、それらフィーダの送り方向と直角な方向に並べて設置する一方、それぞれ吸着ノズルを保持するノズルホルダを、前記フィーダの並び方向に並べて１つの移動部材に保持させ、それらノズルホルダに保持させた複数の吸着ノズルの各々に前記フィーダの各々から電気部品を負圧により吸着して取り出させる方法であって、前記複数の吸着ノズルの少なくとも一部のものの軸間の前記並び方向の距離を調節することと、前記複数のフィーダの各々における前記電気部品の送り停止位置を調節することとの少なくとも一方により、複数のフィーダにより供給される電気部品と複数の吸着ノズルの前記少なくとも一部のものとの位置合わせを行い、それら少なくとも一部の吸着ノズルに複数の電気部品を同時に吸着させる電気部品供給方法。軸間の並び方向の距離は、複数の吸着ノズルの全部について調節可能としてもよく、一部について調節可能としてもよい。前者の場合、軸間の並び方向の距離を、全部の吸着ノズルについて調節し、全部の吸着ノズルが同時に電気部品を吸着するようにしてもよく、一部の吸着ノズルについて調節し、一部の吸着ノズルが同時に電気部品を吸着するようにしてもよい。後者の場合も、一部の吸着ノズルであって、軸間の並び方向の距離が調節可能な複数の吸着ノズルの全部について、軸間の距離が調節されるようにしてもよく、一部の吸着ノズルについて調節されるようにしてもよい。複数の吸着ノズルの軸間の並び方向の距離が調節されるのであれば、例えば、フィーダの部品供給部間の距離が一定でなくても、あるいは複数の吸着ノズルの軸線間の距離やフィーダの部品供給部間の距離に誤差があっても、複数の吸着ノズルの軸間の並び方向の距離を調節することにより、複数の吸着ノズルと複数の電子部品との位置を合わせ、複数の吸着ノズルに電気部品を同時にかつ安定して吸着させることができる。また、複数のフィーダの各々における電気部品の送り停止位置が調節されるのであれば、電気部品の送り停止位置に誤差があり、あるいは吸着ノズルに送り方向に平行な方向の位置誤差等があっても、送り停止位置を調節することにより、複数の吸着ノズルと複数の電気部品との送り方向における位置をそれぞれ合わせ、複数の吸着ノズルに電気部品を同時にかつ安定して吸着させることができる。並び方向の距離と送り停止位置とのいずれか一方を調節するのみでも、吸着精度を向上させることができるが、両方を調節すれば、吸着精度がより向上し、例えば小さい電気部品の吸着をより安定させることができる。

【０００７】（２）前記フィーダとして、電気部品を１列に並べて保持する長手形状のキャリヤテープを長手方向に送ることによって電気部品を送るものを使用し、キャリヤテープの送り停止位置を調節することにより、電気部品の送り停止位置を調節する(1)項に記載の電気部品供給方法。キャリヤテープは，例えば、多数の部品収容凹部がキャリヤテープの長手方向に沿って１列に設けられ、各部品収容凹部に電気部品が１個ずつ収容されるとともに、キャリヤテープに貼り付けられたカバーテープによって部品収容凹部の開口が塞がれたものでもよく、あるいは電気部品のリードを保持して、電気部品を１列に保持するものでもよい。

（３）前記吸着ノズルとして、前記ノズルホルダに保持される被保持部と電気部品を吸着する吸着部とが互いに偏心したものを使用し、ノズルホルダを回転させることにより、前記少なくとも一部の吸着ノズルの吸着部の軸間距離を調節する(1)項または（2)項に記載の電気部品供給方法。本項では、(1)項における「少なくとも一部のものの軸間の並び方向における距離」は、「少なくとも一部の吸着ノズルの吸着部の軸間距離」であることになる。被保持部と吸着部とが互いに偏心させられていれば、ノズルホルダを回転させて、吸着部の中心をノズルホルダの回転軸線のまわりに旋回させ、そのフィーダの並び方向における位置を変え、複数の吸着ノズルの軸間のフィーダ並び方向における距離を調節することができる。例えば、吸着ノズルが保持した電気部品に回転位置誤差（電気部品の吸着ノズルにより吸着される被吸着面に直角な軸線まわりにおける回転位置誤差）を解消すべく、ノズルホルダを回転させ、吸着ノズルを回転させて電気部品を回転させ得るように構成されたものにおいては、そのためのホルダ回転装置を利用して軸間距離を調節するようにすることが可能であり、吸着ノズルの吸着部の軸間距離の調節を容易にかつ安価に行うことができる。

【０００８】（４）前記複数のノズルホルダの少なくとも一部のものを前記移動部材に軸間距離を調節可能に保持させ、それらノズルホルダの軸間距離の調節によって前記少なくとも一部の吸着ノズルの軸間距離を調節する

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(1)項または (2)項に記載の電気部品供給方法。

【０００９】（５）前記電気部品を送る送り装置として、電動モータを駆動源とするものを使用し、その電動モータの回転角度の制御により前記電気部品の送り停止位置を調節する (1)項ないし (4)項のいずれかに記載の電気部品供給方法。電動モータを駆動源とする送り装置は、複数のフィーダにそれぞれ設けられ、電動モータの回転角度の制御により、フィーダ毎に電気部品の送り停止位置が調節される。電動モータの回転角度の制御によれば、電気部品の送り停止位置の調節を容易に行うことができる。送り装置の駆動源たる電動モータをフィーダ外に設け、フィーダには電動モータにより作動させられる作動機構部を設けてもよい。この場合、例えば、駆動源と複数のフィーダとをフィーダの並び方向に平行な方向に相対移動させ、駆動源に複数のフィーダのうちの任意のものを駆動させ得るようにしてもよく、駆動源を複数のフィーダの各送り装置に共用させ、作動機構部に送りピッチの調節機構を設けて電気部品の送り停止位置を調節するようにしてもよい。

【００１０】（６）前記複数のフィーダの各々の部品供給部の前記送り方向に直角な方向における位置と、各フィーダにおける前記電気部品の送り停止位置との少なくとも一方を検出する供給位置検出行程を含み、その供給位置検出行程によって検出した供給位置に基づいて、前記電気部品と複数の吸着ノズルの前記少なくとも一部のものとの位置合わせを行う (1)項ないし (5)項のいずれかに記載の電気部品供給方法。例えば、フィーダの部品供給部近傍に設けた基準マークや、キャリヤテープに保持された電気部品を認識装置に認識させることにより供給位置を検出することが可能である。また、各フィーダにゲージテープを装着し、そのゲージテープを認識装置に認識させることにより供給位置を検出することも可能である。ゲージテープは、キャリヤテープとは別に設けてもよく、キャリヤテープと一体的に設けてもよい。後者の場合、例えば、キャリヤテープの始端部にゲージテープとして機能する部分を印刷，シールの貼付等の適宜の手段によって設ける。電気部品の供給位置を検出すれば、フィーダの製造誤差，位置誤差等により供給位置に位置誤差があっても、それが減少させられるように複数の電気部品と複数の吸着ノズルとの位置合わせが行われ、吸着の安定性が向上する。

（７）前記複数の吸着ノズルの少なくとも一部のものの電気部品を吸着する吸着部の位置を検出する吸着部位置検出行程を含み、その吸着部位置検出行程によって検出した吸着部位置に基づいて、前記電気部品と複数の吸着ノズルの前記少なくとも一部のものとの位置合わせを行う (1)項ないし (6)項のいずれかに記載の電気部品供給方法。吸着ノズルの吸着部の位置を検出すれば、吸着部の位置に位置誤差があっても、それが減少させられるように複数の電気部品と複数の吸着ノズルとの位置合わせ

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が行われ、吸着の安定性が向上する。

【００１１】（８）(1)項ないし (7)項のいずれかに記載の電気部品供給方法により吸着ノズルに保持させた電気部品を、回路基板上の所定の複数個所に装着させることにより電気回路を組み立てる組立行程を含む電気回路製造方法。複数の電気部品がフィーダから同時に取り出されるため、電気部品の取出しに要する時間が短くて済み、電気回路製造能率を向上させることが可能である。

【００１２】（９）回路基板を保持する基板保持装置と、電気部品を１列に並べて部品供給部へ送る複数のフィーダを、それらフィーダの各々の送り方向が前記基板保持装置に保持された回路基板の表面に平行な基準平面上の第一直線に平行となり、かつ、それらフィーダの部品供給部が第一直線と交差する前記基準平面上の第二直線に平行な方向に並ぶ状態で保持するフィーダ保持装置と、複数の吸着ノズルを、それらが前記第二直線に平行な方向に並ぶ状態で、かつ、それぞれ前記基準平面に直角な回転軸線のまわりに回転可能に保持し、自身は前記基準平面の任意の位置に移動可能な移動部材と、前記複数のフィーダの各々における電気部品の前記部品供給部における前記第一直線に平行な方向の停止位置を調節する送り停止位置調節装置と、前記複数の吸着ノズルの少なくとも一部のものの前記第二直線に平行な方向の軸間距離を調節する軸間距離調節装置との少なくとも一方と、その少なくとも一方を制御することにより、前記少なくとも一部の吸着ノズルと前記複数のフィーダにより供給される電気部品との前記第一直線に平行な方向と前記第二直線に平行な方向との少なくとも一方の相対位置を調節し、前記少なくとも一部の吸着ノズルに複数の電気部品を一斉に吸着保持させる部品受取制御装置とを含む電気部品装着システム。第一直線と第二直線とは互いに直交するものであることが望ましい。回路基板には、例えば、絶縁基板に設けられたプリント配線の全部に電気部品が搭載されていないプリント配線板、プリント配線の一部に既に電気部品が搭載されたプリント配線板、プリント配線に電気部品が搭載されるとともに、半田付け接合を終えて一方の面への実装が完了したプリント回路板等が含まれる。複数の吸着ノズルは、複数のフィーダに対して移動させられ、少なくとも一部の吸着ノズルが一斉に複数の電気部品を取り出す。電気部品の送り停止位置と複数のノズルの少なくとも一部のものの軸間距離との少なくとも一方の調節により、(1)項において説明したように、複数の吸着ノズルに電気部品を同時にかつ安定して吸着させることができる。複数の吸着ノズルによって電気部品が一斉に取り出される複数のフィーダは、互いに隣接していてもよく、離れていてもよい。複数の電気部品を保持した複数の吸着ノズルは移動部材によって回路基板へ移動させられ、保持した電気部品を回路基板に設定された被装着位置に装着する。電気部品が回路基板に装着される前に吸着ノズルが回転させられる

とともに電気部品が回転させられ、例えば、電気部品の回転位置誤差が修正され、必要であれば姿勢（回転位置）が変更される。

【００１３】（１０）前記フィーダが、回転角度の制御が可能な電動モータを駆動源とする送り装置を備え、前記送り停止位置調節装置が、その電動モータを制御することにより前記電気部品の送り停止位置を調節する電動モータ制御装置を含む（9)項に記載の電気部品装着システム。電動モータとして、例えば、サーボモータあるいはパルスモータが用いられる。回転角度の制御が可能な電動モータを駆動源とすれば、送り停止位置の調節が容易である。

（１１）前記フィーダが、電気部品を１列に並べて保持する長手形状のキャリヤテープを長手方向に送ることによって電気部品を送るテープ送り装置を備えた（9)項または(10)項に記載の電気部品装着システム。

【００１４】（１２）前記移動部材が、複数のノズルホルダを前記第二直線に平行な方向に並びかつそれら複数のノズルホルダの少なくとも一部のものが各々前記基準平面と直交する回転軸線まわりに回転可能に保持しており、前記軸間距離調節装置が、それら少なくとも一部のノズルホルダを個別に任意の角度回転させ得る複数のホルダ回転装置を含む（9)項ないし(11)項のいずれかに記載の電気部品装着システム。ノズルホルダが回転させられることにより、吸着ノズルが回転させられる。したがって、吸着ノズルの吸着部が、ノズルホルダにより保持される被保持部に対して偏心させられていれば、ノズルホルダが回転させられることにより、吸着部がホルダ回転軸線のまわりに旋回させられ、吸着部のホルダ回転軸線に対する位置が調節されて、複数の吸着ノズルの軸間距離、すなわち複数の吸着ノズルの各々の吸着部の中心間の距離が調節される。吸着部の被保持部に対する偏心は、意図的な偏心でもよく、製造誤差や吸着部を構成する吸着管の曲がり等に起因する偏心誤差でもよい。偏心誤差を利用して軸間距離を調節し、位置誤差を解消する場合、偏心量が不足して位置誤差を全部解消できない場合があり、その場合にはノズルホルダを、吸着部の旋回によって位置誤差が最も減少させられる位置へ回転させる。

【００１５】（１３）前記移動部材が、複数のノズルホルダを前記第二直線に平行な方向に並びかつそれら複数のノズルホルダの少なくとも一部のものがその第二直線に平行な方向に移動可能な状態で保持しており、前記軸間距離調節装置が、その少なくとも一部のノズルホルダを前記第二直線に平行な方向に移動させて、その少なくとも一部のノズルホルダとそれに隣接するノズルホルダとの軸間距離を調節するホルダ移動装置を含む（9)項ないし(11)項のいずれかに記載の電気部品装着システム。本項によれば、吸着ノズルの吸着部と被保持部とを互いに偏心させなくても、吸着部の中心間の距離を調節し、軸間距離を調節することができ、吸着ノズルの吸着部と被保持部とを偏心させ、ノズルホルダの回転によって軸間距離を調節する場合のように、軸間距離の調節により、吸着部の位置に、第一直線に平行な方向のずれを生ずることなく、軸間距離が調節される。

【００１６】（１４）予め定められた位置において、前記複数のフィーダの各々の部品供給部近傍を認識する供給部認識装置と、その供給部認識装置からの情報に基づいて、前記複数のフィーダの各々の部品供給部の前記送り方向に直角な方向における位置と、各フィーダにおける前記電気部品の送り停止位置との少なくとも一方を取得する供給位置取得装置とを含み、前記部品受取制御装置が、その供給位置取得装置により取得された供給位置に基づいて前記少なくとも一方の相対位置の調節を行う(9)項ないし(13)項のいずれかに記載の電気部品装着システム。供給部認識装置は、例えば、撮像装置により構成される。撮像装置は、被写体の二次元像を一挙に取得する面撮像装置としてもよく、ラインセンサにより構成してもよい。ラインセンサは、一直線状に並べられた多数の撮像素子ないし受光素子を有し、被写体と相対移動させつつ繰り返し撮像を行うことによって二次元像が得られる。本項は、例えば、(6)項と同様に説明され、(6)項に記載の作用，効果が得られる。

（１５）予め定められた位置において、前記複数の吸着ノズルの少なくとも一部のものの電気部品を吸着する吸着部を認識する吸着部認識装置と、その吸着部認識装置からの情報に基づいて前記吸着部の位置を取得する吸着部位置取得装置とを含み、前記部品受取制御装置が、その吸着部位置取得装置により取得された吸着部位置に基づいて前記少なくとも一方の相対位置の調節を行う(9)項ないし(14)項のいずれかに記載の電気部品装着システム。吸着部認識装置は、例えば、撮像装置により構成される。本項によれば、例えば、(7)項に記載の作用，効果が得られる。

【００１７】

【発明の実施の形態】以下、本発明の実施形態を図面に基づいて詳細に説明する。本発明の実施形態の１つである電子部品装着システムが図１に示されている。図１において１０は、電子部品装着システムのシステム本体としてのベースである。ベース１０上には、回路基板の一種であるプリント配線板１４を搬送する配線板コンベヤ１６，プリント配線板１４を保持する基板保持装置としての配線板保持装置１８，プリント配線板１４に電気部品の一種である電子部品２０（図３参照）を装着する部品装着装置２２および部品装着装置２２に電子部品２０を供給する部品供給装置２４，２６等が設けられている。

【００１８】配線板コンベヤ１６は、図１に概略的に示すように、一対のガイドレール３０，３２を備えている。一対のガイドレール３０，３２にはそれぞれ、無端

の巻掛体たるコンベヤベルト（図示省略）が巻き掛けられており、プリント配線板１４はコンベヤベルト上に載せられ、これら１対のコンベヤベルトがベルト駆動装置（図示省略）によって同期して周回させられることにより、プリント配線板１４が搬送される。

【００１９】本実施形態においてプリント配線板１４は、配線板コンベヤ１６により水平な姿勢で搬送され、図示を省略する停止装置によって予め定められた作業位置において停止させられるとともに、ベース１２の作業位置に対応する部分に設けられた配線板保持装置１８により保持される。本実施形態においてプリント配線板１４は、その電子部品２０が装着される被装着面であって上面である表面２８（図２参照）が水平な姿勢で保持される。

【００２０】本電子部品装着システムにおいては、その全体についてＸＹ座標面が水平に設定されている。このＸＹ座標面がプリント配線板１４の表面２８に平行な基準平面を構成し、ＸＹ座標面上において互いに直交する２軸の一方であるＸ軸が基準平面上の第二直線を構成し、他方であるＹ軸が基準平面上の第一直線を構成している。本実施形態においてプリント配線板１４は、配線板コンベヤ１６によりＸ軸方向に平行な方向に搬送される。

【００２１】部品供給装置２４，２６は、図１および図２に示すように、Ｙ軸方向に互いに隔たって、配線板コンベヤ１６の両側に位置を固定して静止して設けられている。図示の例においては、部品供給装置２４，２６はいずれもフィーダ型部品供給装置とされている。部品供給装置２４，２６の構成は同じであり、部品供給装置２４を代表的に説明する。また、部品供給装置２４，２６は、特開平１０－１１２５９８号公報に記載の部品供給装置とほぼ同様に構成されており、簡単に説明する。

【００２２】部品供給装置２４は、多数のフィーダ４０がフィーダ支持テーブル４２上に配列された部品供給テーブル４４を有する。フィーダ４０は、本実施形態では、図６および図７に示すように、電子部品２０をキャリヤテープ４８に保持させてテーピング電子部品５０とした状態で供給するものとされている。

【００２３】キャリヤテープ４８は長手形状を成し、多数の部品収容凹部５２が長手方向に平行な方向において等間隔に、かつ１列に形成されるとともに、部品収容凹部５２の各々に電子部品２０が１個ずつ収容され、それら部品収容凹部５２の開口がキャリヤテープ４８に貼り付けられたカバーテープ５４によって塞がれることにより、キャリヤテープ送り時等における電子部品２０の部品収容凹部５２からの飛び出しが防止されている。キャリヤテープ４８は電子部品２０を１列に並べて保持しているのである。部品収容凹部５２の形成ピッチを部品収容ピッチないし送りピッチと称する。キャリヤテープ４８にはまた、多数の送り穴５６が、キャリヤテープ４８の長手方向に沿って等間隔に設けられている。このように構成されたテーピング電子部品５０は、部品収容器たる部品収容リール５８に巻き付けられた状態でフィーダ４０にセットされる。

【００２４】フィーダ４０は、フィーダ本体６２，部品収容リール５８を保持する部品収容器保持装置ないしテープ保持装置たるリール保持装置６４，テープ送り装置としてのキャリヤテープ送り装置６６およびカバーテープ剥がし装置６８を有する。フィーダ本体６２には、図５に示すように、位置決め部７０が設けられ、フィーダ支持テーブル４２に設けられた係合溝７２に嵌合されて幅方向がＸ軸方向に平行に位置決めされるとともに、係合部材７４に係合させられて前後方向の位置決めおよび浮上がり防止が為され、係合レバー７６によってフィーダ支持テーブル４２に着脱可能に係止されている。本実施形態においては、フィーダ支持テーブル４２，係合溝７２，係合部材７４および係合レバー７６等がフィーダ保持装置７８を構成している。フィーダ４０の前後方向は長手方向に平行な方向であり、複数のフィーダ４０はフィーダ保持装置７８により、長手方向がＹ軸方向に平行となる姿勢で位置決めされるとともに、複数のフィーダ４０の各部品供給部がＸ軸方向に平行な一直線上に並んで保持されている。なお、本実施形態においては、説明を簡単にするために、フィーダ保持装置７８によるフィーダ４０の保持ピッチは一定とされ、幅が大きいフィーダ４０は、複数ピッチ分のスペースを用いて保持されることとする。保持ピッチは、隣接するフィーダ４０の後述する各部品供給部の設計上の位置のＸ軸方向における距離である。

【００２５】リール保持装置６４は、フィーダ本体６２に回転可能に取り付けられた回転支持部材たる複数の支持ローラ８０を備え、部品収容リール５８を回転可能に支持している。部品収容リール５８から引き出されたテーピング電子部品５０は、フィーダ本体６２に設けられた案内部材８８上に載せられ、下方から支持された状態でキャリヤテープ送り装置６６によって前方へ、すなわち配線板コンベヤ１６側へ送られる。

【００２６】キャリヤテープ送り装置６６は、パルスモータ１００，駆動ギヤ１０２，それぞれフィーダ本体６２に回転可能に取り付けられた被駆動ギヤ１０４，駆動プーリ１０６，駆動ベルト１０８，被駆動プーリ１１０およびスプロケット１１２を備えている。スプロケット１１２の歯１１４には、テーピング電子部品５０の送り穴５６が係合させられ、スプロケット１１２が回転させられることによりテーピング電子部品５０がその長手方向ないしフィーダ４０の長手方向であって、Ｙ軸方向に平行な方向に送られ、電子部品２０が１列に並べられて部品供給部へ送られる。電子部品２０は複数のフィーダ４０の並び方向と直角な方向に送られるのである。また、駆動ギヤ１０２等は、パルスモータ１００の回転を

スプロケット１１２に伝達する回転伝達装置を構成している。

【００２７】パルスモータ１００は回転角度の制御が可能な電動モータたる回転電動モータの一種であり、キャリヤテープ送り装置６６の駆動源を構成しており、駆動信号の制御によりパルスモータ１００の回転角度が制御される。それにより、テーピング電子部品５０の送り長さが調節され、テーピング電子部品５０ないし電子部品２０の送り停止位置が調節される。フィーダ４０の電子部品２０の供給位置は、Ｙ軸方向においては送り停止位置によって決められるが、その送り停止位置が調節されるのである。

【００２８】キャリヤテープ５４のスプロケット１１２に係合させられた部分およびその前後の部分にはカバー１１５（図８参照）が被せられ、カバーテープ５４の剥がし時におけるテーピング電子部品５０のフィーダ本体６２からの浮き上がりが防止されている。カバー１１５には、図８に示すように、開口１１７が設けられ、電子部品２０の部品装着装置２２による取出しが許容されるようにされている。この開口１１７を含む部分がフィーダ４０の部品供給部１２２を構成している。

【００２９】スプロケット１１２には、図９に示すように被検出部材１１６が相対回転不能に設けられている。被検出部材１１６は、有底の円筒上を成し、その周壁１１８にはスリット１２０が等角度間隔に設けられている。スリット１２０の周方向のピッチは、このスプロケット１１２が設けられたフィーダ４０により送られるテーピング電子部品５０の部品収容凹部５２の形成ピッチの整数倍とされている。被検出部材１１６に近接して検出装置たる光電センサ１２４が設けられている。光電センサ１２４は発光部１２６および受光部１２８を有し、本実施形態においては透過型とされており、発光部１２６および受光部１２８が周壁１１８の両側にそれぞれ、互いに対向して配設されている。したがって、スプロケット１１２が回転させられ、それと共に被検出部材１１６が回転させられるとき、発光部１２６および受光部１２８がスリット１２０に対向する状態では受光部１２８が受光し、周壁１１８のスリット１２０以外の部分が対向する状態では受光部１２８は受光しない。光電センサ１２４は、受光部１２８が受光しない状態から受光する状態となり、その受光量が設定値を超えたとき、その検出信号がＯＦＦ信号からＯＮ信号に変わるように構成されている。

【００３０】光電センサ１２４は、スプロケット１１２の回転軸線まわりの位置が調節可能に設けられている。光電センサ１２４の位置は、テーピング電子部品５０の部品収容凹部５２がカバー１１５の開口１１７内の位置であって、部品供給部１２２の予め定められた位置である供給位置に位置する状態において、検出信号がちょうどＯＦＦ信号からＯＮ信号に変化する位置に予め調節されている。この調節はオペレータによって行われる。この供給位置は、例えば、部品収容凹部５２が開口の予め設定された位置、例えば、中央に位置する位置であり、あるいはスプロケット１１２の歯１１４がカバー１１５に設けられた長穴内に所定の状態で位置する状態となる位置である。

【００３１】被検出部材１１６のスリット１２０は、周方向において、テーピング電子部品５０の部品収容ピッチの整数倍のピッチで形成されており、例えば、１倍、すなわち部品収容ピッチと同じピッチで形成されている場合、キャリヤテープ送り装置６６に送り誤差がなければ、パルスモータ１００が設計上、設定された角度回転させられたとき、テーピング電子部品５０が１ピッチ、すなわち部品収容ピッチに等しい距離送られるとともに、光電センサ１２４の検出信号がＯＦＦ信号からＯＮ信号に変化する。

【００３２】しかし、スプロケット１１２はパルスモータ１００に直結されておらず、パルスモータ１００の回転が回転伝達装置を介してスプロケット１１２に伝達されるため、スプロケット１１２の回転に誤差が生ずる。この誤差の大きさは、光電センサ１２４の検出信号がＯＦＦ信号からＯＮ信号に変化したときのパルスモータ１００の実際の回転角度と、設計上の回転角度とから得られる。例えば、テーピング電子部品５０の１ピッチの送りに要するパルスモータ１００の設計上の回転角度をＮ・θMU、光電センサ１２４の検出信号がＯＦＦ信号からＯＮ信号に変化したときのパルスモータ１００の回転角度をθMNとすれば、送り誤差は、Ｎ・θMUから角度θMNを引くことにより得られる。Ｎは、テーピング電子部品５０の送り回数である。なお、本実施形態においては、パルスモータ１００を作動させるためのパルスの数がカウントされ、回転角度はパルス数で得られるようになっているが、パルスモータの回転角度をエンコーダ等の回転角度検出装置によって検出するようにしてもよい。

【００３３】キャリヤテープ送り装置６６の送り誤差が、スプロケット１１２の回転角度が過剰となる向きに生ずる例を図１０に示す。送り誤差は、送り回数Ｎの増大に伴って累積する。そのため、光電センサ１２４の検出信号がＯＦＦ信号からＯＮ信号に変化する毎に送り誤差が求められるとともに、その絶対値が設定値と比較される。この送り誤差は累積した誤差であり、設定値以下であれば誤差が小さく、支障はないと判定される。それに対し、設定値を超えれば、誤差が大きく、パルスモータ１００の作動指令値が修正されるとともに、リセットされる。例えば、累積誤差の絶対値が設定値を超えたことが検出された際のテーピング電子部品５０の送りの次の送り時に、累積誤差分、パルスモータ１００の回転角度が小さくなるように作動指令値が修正されるとともに、その次の送り開始時に回転角度Ｎ・θMUおよびθMNが０にリセットされるのである。それにより送り誤差が

際限なく累積し、電子部品２０の部品供給部への位置決め精度が低下することが回避される。

【００３４】前記カバーテープ剥がし装置６８は、図５に示すように、回転剥がし部材たる１対のピンチローラ１３４，１３６，一方のピンチローラ１３４に前記キャリヤテープ送り装置６６の駆動プーリ１０６の回転を伝達する駆動ベルト１３８，被駆動プーリ１４０を備えており、ピンチローラ１３４が回転させられ、ピンチローラ１３６が回転させられることにより、ピンチローラ１３４，１３６の間に弾性的に挟まれたカバーテープ５４が送られるとともに、キャリヤテープ４８から剥がされる。キャリヤテープ送り装置６６とカバーテープ剥がし装置６８とは駆動源を共用しており、テーピング電子部品５０の送りとカバーテープ５６の剥がしとが同時に行われる。キャリヤテープ５４から剥がされたカバーテープ５４は、カバー１１５に設けられたスリット１４４（図８参照）から外へ引き出され、案内部材たる案内管１４２を通って下方へ排出される。なお、キャリヤテープ送り装置６６，カバーテープ剥がし装置６８を構成する回転巻掛体たるプーリおよび巻掛体たるベルトはそれぞれ、本実施形態においては、タイミングプーリおよびタイミングベルトとされている。

【００３５】部品装着装置２２を説明する。部品装着装置２２は、複数、本実施形態においては３つの部品装着ユニット１５０およびこれら部品装着ユニット１５０を移動させるＸＹロボット１５２を備えている。３つの部品装着ユニット１５０はＸＹロボット１５２により、前記ＸＹ座標面内の任意の位置へ直線移動させられて電子部品２０を搬送し、プリント配線板１４の表面２８に装着する。

【００３６】ＸＹロボット１５２は、図１に示すように、ベース１０上にＹ軸方向に移動可能に設けられたＹ軸スライド１６０と、Ｙ軸スライド１６０を移動させるＹ軸スライド移動装置１６２と、Ｙ軸スライド上にＸ軸方向に移動可能に設けられたＸ軸スライド１６４と、Ｘ軸スライド１６４を移動させるＸ軸スライド移動装置１６６とを含む。

【００３７】Ｙ軸スライド移動装置１６２は、Ｙ軸スライド移動用モータ１６８を駆動源とし、その回転が、Ｙ軸方向に平行に設けられた送りねじたるボールねじ１７０およびＹ軸スライド1.６４に固定のナット１７２を含む運動変換装置によってＹ軸スライド１６０の直線運動に変換され、Ｙ軸スライド１６０が１対のレール状の案内部材１７４およびブロック状の被案内部材１７６を含む案内装置により案内されてＹ軸方向に移動させられる。これらボールねじ１７０および案内部材１７４は、ベース１２上に立設された複数のコラム１７８により、配線板コンベヤ１４および部品供給装置２４，２６の上方に設けられている。本部品装着装置２２は、所謂天吊り型の装置なのである。

【００３８】Ｘ軸スライド移動装置１６６は、図２に示すように、Ｘ軸スライド移動用モータ１８０を駆動源とし、その回転が、Ｙ軸スライド１６０上にＸ軸方向に平行に設けられた送りねじたるボールねじ１８２およびＸ軸スライド１６４に固定のナット１８４（図３参照）を含む運動変換装置により、Ｘ軸スライド１６４の直線運動に変換され、Ｘ軸スライド１６４がレール状の案内部材１８６およびブロック状の被案内部材１８８を含む案内装置により案内されてＸ軸方向に移動させられる。Ｘ軸スライド１６４は、Ｘ軸スライド移動装置１６６によってＸ軸方向に移動させられ、Ｙ軸スライド１６０がＹ軸スライド移動装置１６２によってＹ軸方向に移動させられることにより、ＸＹ座標面内の任意の位置に移動可能であり、本実施形態においてはＸ軸スライド１６４が移動部材を構成している。Ｘ軸スライド１６４とは別に移動部材が設けられ、Ｘ軸スライド１６４と一体的に設けられていると考えてもよい。

【００３９】前記３つの部品装着ユニット１５０は、Ｘ軸スライド１６４上にＸ軸方向に平行に一列に並んで設けられている。これら部品装着ユニット１５０の構成は同じであり、１つを代表的に説明する。部品装着ユニット１５０は、図３に示すように、吸着ノズル２００，ノズルホルダ２０２，ノズルホルダ２０２を前記水平なＸＹ座標面に直角な方向である垂直方向に平行な方向に移動させ、昇降させてプリント配線板１４に接近，離間させるホルダ移動装置ないし接近・離間装置たるホルダ昇降装置２０４，ノズルホルダ２０２をその垂直な回転軸線まわりに回転させるホルダ回転装置２０６を含む。

【００４０】ホルダ昇降装置２０４は、Ｘ軸スライド１６４に垂直方向に移動可能に設けられた移動部材たる昇降部材２１０および昇降部材移動装置２１２を備えている。昇降部材移動装置２１２は、昇降用モータ２１６を駆動源とし、その回転が、駆動プーリ２１８，被駆動プーリ２２０および駆動ベルト２２２を含む回転伝達装置により送りねじたるボールねじ２２４に伝達される。ボールねじ２２４は、Ｘ軸スライド１６４に垂直軸線まわりに回転可能かつ軸方向に移動不能に設けられるとともに、昇降部材２１０に固定のナット２２６に螺合されており、ボールねじ２２４が回転させられることにより、昇降部材２１０が昇降させられる。昇降部材２１０の昇降は、Ｘ軸スライド１６４に垂直方向に設けられた１対のレール状の案内部材（図３には１つが図示されている）２２８を含む案内装置により案内される。なお、駆動プーリ２１８，被駆動プーリ２２０はタイミングプーリにより構成され、駆動ベルト２２２はタイミングベルトにより構成されている。

【００４１】前記ノズルホルダ２０２は、昇降部材２１０に垂直軸線まわりに回転可能に設けられ、吸着ノズル２００を着脱可能に保持しており、ノズルホルダ２０２が回転させられることにより、吸着ノズル２００が垂直

な回転軸線まわりに回転させられる。また、ノズルホルダ２０２は昇降部材２１０が昇降させられることにより昇降させられ、それにより吸着ノズル２００が昇降させられる。ノズルホルダ２０２は、本実施形態では、例えば、特許第３０９３３３９号公報に記載のノズルホルダと同様に構成されており、詳細な図示および説明は省略する。昇降部材２１０のノズルホルダ２０２を保持する部分およびノズルホルダ２０２が装着ヘッドを構成している。

【００４２】前記ホルダ回転装置２０６は、昇降部材２１０に設けられている。ホルダ回転装置２０６は、回転用モータ２４０を駆動源とし、ホルダ回転用モータ２４０の回転が駆動ギヤ２４２，被駆動ギヤ２４４によりノズルホルダ２０２に伝達され、ノズルホルダ２０２が垂直な自身の軸線まわりに正逆両方向に任意の角度回転させられる。

【００４３】前記吸着ノズル２００は、ノズル本体２５０およびノズル本体２５０に嵌合された吸着管２５２を有する。ノズル本体２５０が被保持部を構成し、吸着管２５２が吸着部を構成し、ノズル本体２５０においてノズルホルダ２０２により、軸方向に相対移動可能かつ相対回転不能に保持されている。本実施形態においては、ノズル本体２５０は、ノズルホルダ２０２により同心状に保持されているが、吸着管２５２はノズル本体２５０に対して偏心した位置に嵌合されており、図４に示すように、吸着管２５２の先端面により構成される吸着面２５４は、ノズル本体２５０およびノズルホルダ２０２に対して偏心させられている。

【００４４】したがって、ノズルホルダ２０２が回転させられれば、吸着面２５４がホルダ回転軸線のまわりに旋回させられ、そのＸ軸，Ｙ軸方向の位置が変えられ、それにより、隣接する吸着ノズル２００の吸着面２５４の中心間の距離が調節され、後述するように、吸着面２５４のフィーダ４０の供給位置に対するＸ軸方向の位置が変えられて、Ｘ軸方向における各種位置誤差が修正される。

【００４５】吸着ノズル２００は負圧により電子部品２０を吸着するものであり、ノズルホルダ２０２内等に設けられた通路等を経て、図示を省略する負圧源，正圧源および大気に接続されており、電磁方向切換弁装置（図示省略）の切換えにより、吸着管２５２が負圧源，正圧源および大気に択一的に連通させられて電子部品２０を吸着保持し、解放する。

【００４６】また、被駆動ギヤ２４４には、発光体たる発光板２６０が相対回転不能に設けられ、吸着ノズル２００のまわりに配設されている。発光板２６０は、図示の例では、円板状を成し、その下面には蛍光塗料が塗布されて発光面２６２を構成している。

【００４７】なお、本実施形態においては、説明を簡単にするために、３個の吸着ノズル２００の種類は同じであり、部品供給装置２４，２６の複数のフィーダ４０により供給される電子部品２０の種類は異なっても、吸着ノズル２００はいずれの種類の電子部品２０も保持することができることとする。

【００４８】また、３つの部品装着ユニット１５０は、各ノズルホルダ２０２の回転軸線間のＸ軸方向に平行な方向のピッチ（設計上の正規のピッチ）が、フィーダ支持テーブル４２におけるフィーダ保持ピッチの整数倍となるように設けられている。

【００４９】Ｘ軸スライド１６４にはまた、図３に示すように、プリント配線板１４に設けられた基準マーク２７０（図１参照）を撮像する基準マーク撮像システム２７２が設けられている。基準マーク２７０は、複数、図示の例では２個、プリント配線板１４の対角線に隔たった位置にそれぞれ設けられている。基準マーク撮像システム２７２は、撮像装置たる基準マークカメラ２７４（図３参照）および照明装置（図示省略）を備えている。

【００５０】基準マークカメラ２７４は、本実施形態においては、固体イメージセンサの一種であるＣＣＤ（電荷結合素子）を有する撮像部と、結像レンズを含むレンズ系とを備え、本実施形態では、被写体の二次元像を一挙に取得する撮像装置の一種である面撮像装置とされている。ＣＣＤは、一平面上に多数の微小な受光素子が配列されたものであり、各受光素子の受光状態に応じた電気信号を発生させる。多数の受光素子により撮像領域ないし撮像画面が形成されている。基準マークカメラ２７４は、その中心軸線が垂直となり、かつ下向きの姿勢で設けられている。

【００５１】前記ベース１０上には、図１に示すように、配線板コンベヤ１６と部品供給装置２４，２６との間の位置にそれぞれ、部品撮像システム２８０が位置を固定して設けられている。これら部品撮像システム２８０の構成は同じであり、一方を代表的に説明する。

【００５２】部品撮像システム２８０は、撮像装置たる部品カメラ２８２および照明装置（図示省略）を備えている。部品カメラ２８２は、本実施形態では、前記基準マークカメラ２７４と同様にＣＣＤカメラによって構成されるとともに面撮像装置とされ、その中心軸線が垂直にかつ上向きとなる姿勢で設けられている。照明装置は部品カメラ２８２に近接して設けられ、本実施形態においては、紫外線と可視光線とを被写体に向かって選択的に放射するように構成されており、部品カメラ２８２は、被写体の投影像あるいは正面像を撮像する。

【００５３】本電子部品装着システムは、図１１に示す制御装置３００によって制御される。ただし、図１１は、本システムのうち本発明に関連の深い部分を取り出して示したものである。制御装置３００はコンピュータ３０２を主体とするものであり、プロセッシングユニット（ＰＵと略記する）３０４，リードオンリメモリ（R

ＯＭ）３０６，ランダムアクセスメモリ（ＲＡＭ）３０８，入力ポート３１０および出力ポート３１２がバスラインによって接続されたものである。入力ポート３１０には、前記基準マークカメラ274および部品カメラ２８２により撮像された画像のデータを解析する画像処理コンピュータ３１６，前記光電センサ１２４，エンコーダ３２０等、種々の検出器やコンピュータが接続されている。

【００５４】出力ポート３１２には、それぞれ駆動回路３２４を介して前記パルスモータ１００等、各種アクチュエータが接続されている。モータ１６８，１８０，２１６，２４０はそれぞれ駆動源を構成し、本実施形態では、回転角度の制御が可能な電動モータの一種である回転電動モータとしてのサーボモータにより構成されている。サーボモータに代えてパルスモータを用いてもよい。また、Ｙ軸スライド駆動用モータ１６８等の回転角度はそれぞれ、回転角度検出装置としてのエンコーダにより検出され、その検出結果に基づいてモータ１８０等が制御される。図１１においては、Ｙ軸スライド駆動用モータ１６８について設けられたエンコーダ３２０を代表的に示す。ＲＡＭ３０８には、吸着ノズル２００に部品供給装置２４，２６から電子部品２０を受け取らせ、プリント配線板１４に装着させることにより電子回路を組み立てるためのプログラム、ノズルホルダ２０２の回転軸線等の位置誤差等を検出するためのプログラム等、種々のプログラムおよびデータ等が記憶させられている。

【００５５】電子部品装着システムの作動を説明する。本電子部品装着システムにおいては、電子部品２０のプリント配線板１４への装着作業の開始に先立って、３個のノズルホルダ２０２の各回転軸線（以下、ホルダ回転軸線と称する）の位置誤差，３個の吸着ノズル２００の各吸着面２５４の偏心，部品供給装置２４，２６の全部のフィーダ４０の各部品供給部１２２の位置誤差が検出され、吸着ノズル２００による電子部品２０の受取り時に、吸着面２５４の偏心の利用および電子部品２０の送り停止位置の調節により位置誤差が解消され、吸着ノズル２００と電子部品２０との位置が合わされて、複数の吸着ノズル２００により複数の電子部品２０が同時に安定して吸着されるようにされる。

【００５６】ホルダ回転軸線の位置誤差および吸着面２５４のホルダ回転軸線に対する偏心は、吸着面２５４を部品カメラ２８２によって撮像することにより検出され、部品供給部１２２の位置誤差は、後述するように、フィーダ４０にゲージテープをセットし、基準マークカメラ２７４によって撮像することにより検出される。そのため、検出時には、３個のノズルホルダ２０２および基準マークカメラ２７４がそれぞれ、ＸＹロボット１５２により、予め設定された移動データに従って移動させられて吸着面２５４が撮像され、ゲージテープが撮像されるのであるが、本実施形態においては、問題の単純化のために、基準マークカメラ２７４および部品カメラ２８２のＸ軸スライド１６４（ＸＹロボット１５２）に対する位置は予め調節されて誤差が除かれ、予め設定された相対位置に位置する状態が得られるようにされるとともに、ＸＹロボット１５２の原点位置誤差，送り誤差が除かれている状態を想定して、ホルダ回転軸線の位置誤差等の取得および吸着面２５４と電子部品２０との位置合わせを説明する。

【００５７】ホルダ回転軸線の位置誤差の検出を説明する。ノズルホルダ２０２には、製造誤差，組付誤差等により、ホルダ回転軸線に位置誤差が生じる。位置誤差の検出時には、３個のノズルホルダ２０２が順次、部品カメラ２８２上へ移動させられる。この移動のためのデータは、３個のノズルホルダ２０２の各回転軸線の設計上の正規の位置についてそれぞれ作成され、ホルダ回転軸線が撮像中心と一致するように作成されている。

【００５８】ホルダ回転軸線の位置誤差検出時には、３個のノズルホルダ２０２にはそれぞれ吸着ノズル２００が保持され、吸着ノズル２００が複数、例えば、２つの回転位置に位置する状態においてそれぞれ、吸着ノズル２００の吸着面２５４が部品カメラ２８２によって撮像される。この際、吸着面２５４の正面像が撮像される。部品撮像システム２８０の照明装置から可視光線が照射され、吸着面２５４からの反射光に基づいて吸着面２５４が撮像されるのである。

【００５９】撮像のための２つの回転位置の一方は、本実施形態では、例えば、ホルダ回転用モータ２４０が０点位置に位置し、ノズルホルダ２０２が０点位置に位置する際の位置とされ、他方は、０点位置から１８０度隔たった位置とされている。ホルダ回転用モータ２４０の回転角度を検出するエンコーダの０点位置が機械的（ハード的）に検出され、ホルダ回転用モータ２４０の０点位置が検出される。ホルダ回転用モータ２４０が０点位置に位置する際のノズルホルダ２０２の回転位置を回転原位置と称する。

【００６０】ノズルホルダ２０２が一方の撮像位置に位置する状態で吸着面２５４が撮像されたならば、ノズルホルダ２０２が１８０度回転させられ、他方の撮像位置において撮像され、撮像データは画像処理コンピュータ３１６において処理される。一方の撮像位置における撮像により、撮像画面上において図１２(a) に示すように、吸着ノズル２００の吸着面２５４の外形の像が得られ、他方の撮像位置における撮像により、図１２(b) に示すように吸着面２５４の外形の像が得られたとすれば、これら２つの像は１８０度隔たった位置に形成されており、各像の中心点の座標をM1 （x1，y1），M2 （x2，y2）とすれば、これら２点の中央位置がホルダ回転軸線Ａの位置であり、その座標は｛（x1 ＋x2）／2，（y1 ＋y2）／2｝である。ホルダ回転軸

線Ａの撮像中心に対する位置が実際のホルダ回転軸線の設計上の正規のホルダ回転軸線に対する位置誤差ΔＸＡ，ΔＹＡ であり、ノズルホルダ２０２を特定するデータ（例えば、ノズルホルダ２０２のＸ軸スライド１６４における取付位置データ）と対応付けてＲＡＭ３０８に記憶される。なお、本実施形態においては、理解を容易にするために、吸着面２５４の撮像により得られる像についても、吸着面２５４と同じ符号を付して示す。

【００６１】吸着面２５４の偏心の検出を説明する。吸着管２５２はノズル本体２５０に対して意図的に偏心させられており、その偏心量は設計上、わかっているが、吸着管２５２の製造誤差，組付誤差や吸着管２５２の曲がり等に起因する偏心誤差により、実際の偏心量が設計上の大きさであるとは限らず、吸着面２５４の撮像に基づいて正確な偏心量が取得される。

【００６２】ノズルホルダ２０２には、種類が同じあるいは異なる複数の吸着ノズル２００が保持されるが、保持される吸着ノズル２００が異なっても、ホルダ回転軸線の位置は同じであるのに対し、吸着ノズル２００の吸着面２５４の位置は、吸着ノズル２００の種類によって変わることがあり、また、同じ吸着ノズル２００でもノズルホルダ２０２に着脱される毎に変わることがあり、吸着ノズル２００がノズルホルダ２０２に保持されて電子部品２０の装着に用いられる毎に検出される。

【００６３】電子部品２０の装着に使用される吸着ノズル２００がノズルホルダ２０２に保持されたならば、ノズルホルダ２０２が部品カメラ２８２へ移動させられる。この際、ホルダ回転軸線の設計上の正規の位置に基づいて作成された移動データが先に取得したホルダ回転軸線の位置誤差に基づいて修正され、ノズルホルダ２０２は、ホルダ回転軸線が部品カメラ２８２の撮像中心と一致する位置へ移動させられる。撮像時には、ノズルホルダ２０２は回転原位置に位置させられていて、吸着面２５４の正面像が部品カメラ２８２により撮像される。そして、図１３に示すように、吸着面２５４の外形の像が得られたとすれば、その中心位置が求められ、その撮像中心に対する位置が、吸着面２５４の中心のホルダ回転軸線に対する偏心ΔＸＮ，ΔＹＮ として、吸着ノズル２００を特定するデータ（例えば、吸着ノズル２００を保持するノズルホルダ２０２を特定するデータ）と対応付けてＲＡＭ３０８に記憶される。吸着ノズル２００はノズルホルダ２０２により相対回転不能に保持されるため、吸着ノズル２００がノズルホルダ２０２に保持されて検出された吸着面２５４の偏心は、ノズルホルダ２０２が回転原位置に位置する状態において、ホルダ回転軸線に対して同様に生ずる。吸着ノズル２００の偏心は、３つのノズルホルダ２０２にそれぞれ保持された吸着ノズル２００の全部について、それぞれ取得される。

【００６４】部品供給部１２２の位置誤差の検出を説明する。部品供給位置１２２の位置誤差の検出には、本実施形態では、図１４に示すゲージテープ３５０が用いられる。ゲージテープ３５０には、前記テーピング電子部品５０のキャリヤテープ４８に形成された送り穴５６と同じ形状，寸法を有する係合穴３５２が複数、ゲージテープ３５０の長手方向に沿って送り穴５６の形成ピッチと同じピッチで形成されるとともに、部品収容凹部５２の横断面形状と同じ形状，寸法を有する基準マーク３５４が、部品収容凹部５２の形成ピッチの整数倍のピッチで形成されている。係合穴３５２と基準マーク３５４との相対位置は、テープ長手方向、すなわち電子部品２０の送り方向に平行な方向においても、幅方向、すなわち送り方向と直交する方向においても寸法精度良く作られ、テーピング電子部品５０の送り穴５６と部品収容凹部５２との正規の相対位置と同じ相対位置に精度良く作られている。また、ゲージテープ３５０の基準マーク３５４と基準マーク３５４以外の部分とは、光学的特性、例えば、色，輝度あるいは明度が異ならされ、基準マーク３５４と、ゲージテープ３５０の基準マーク３５４以外の部分とについてコントラストの大きい像が得られ、基準マーク３５４の像が明瞭に得られ、その位置が精度良く得られるようにされている。例えば、両者の色が異ならされ、ゲージテープ３５０は白色とされ、基準マーク３５４は黒色とされる。

【００６５】２つの部品供給装置２４，２６の各複数のフィーダ４０の各々についてゲージテープ３５０がセットされる。係合穴３５２をスプロケット１１２の歯１１４に係合させ、スプロケット１１２を回転させてゲージテープ３５０を送り、光電センサ１２４の検出信号がＯＦＦ信号からＯＮ信号に変化する位置で停止させ、吸着面３５４を部品供給部１２２に位置させるのである。カバー１１５はゲージテープ３５０に被せてもよく、基準マーク３５４の撮像を妨げないのであれば、被せなくてもよい。ゲージテープ３５０の基準マーク３５４と係合穴３５２とは、テーピング電子部品５０の部品収容凹部５２と送り穴５６との正規の相対位置と同じ相対位置に位置するように精度良く形成されており、基準マーク３５４は電子部品２０を供給する部品収容凹部５２と同様に部品供給部１２２に位置させられ、スプロケット１１２に対して精度良く位置決めされる。なお、ゲージテープ３５０をフィーダ４０からセットするとき、テープ化電子部品５０が既にフィーダ４０にセットされていれば、少なくともスプロケット１１２から外される。

【００６６】ゲージテープ３５０のセット後、基準マークカメラ２７４が複数のフィーダ４０の各部品供給部１２２へ順次移動させられて、基準マーク３５４を撮像する。撮像時の基準マークカメラ２７４の移動データは、その撮像中心について作成され、撮像画面の中心である撮像中心が、全部のフィーダ４０についてそれぞれ設定された設計上の正規の供給位置と一致する位置に基準マークカメラ２７４が移動するように作成されている。そ

させられる。それにより、テーピング電子部品５０の送り長さが、位置ずれがない場合に比較して長く、あるいは短くされて電子部品２０の送り停止位置が調節され、図１６(c)に示すように、実際の供給位置が電子部品２０が吸着面２５４との位置が合う位置に停止させられ、吸着面２５４と吸着ノズル２００との位置が合わされる。

【００８１】左右両側の吸着ノズル２００についてはそれぞれ、吸着面２５４の中心の実際の供給位置に対するＹ軸方向の位置は、左側の吸着ノズル２００を例に取れば、ΔＹA1，ΔＹN1，ΔＹF1に加えて、中央のノズルホルダ２０２の回転軸線を部品供給位置に合わせるためのΔＹA2，ΔＹF2に基づく移動データの修正量および吸着面２５４の中心と供給位置とをＸ軸方向において合わせるために生ずるＹ軸方向の位置ずれに基づいて得られる。そして、位置ずれが解消され、Ｙ軸方向において吸着面２５４の中心と実際の供給位置とが合わされるようにテーピング電子部品５０の送り停止位置が調節され、図１６(c)に示すように、吸着面２５４の中心と実際の供給位置とが合わされ、吸着面２５４と電子部品２０との位置が合わされる。右側の吸着ノズル２００についても同様である。

【００８２】前述のように、吸着面２５４と実際の供給位置とのＸ軸方向の位置合わせのためにノズルホルダ２０２が回転角度が少なくても済む方向へ回転させられるが、本実施形態では、両者の位置がＸ軸方向において合わされたとき、吸着面２５４が開口１１７から外れず、吸着面２５４の中心と実際の供給位置との部品送り方向における位置ずれが電子部品２０の送り停止位置の調節により解消し得るようにされている。なお、開口１１７等の都合によっては、ノズルホルダ２０２を回転角度が小さくて済む方向へ回転させるのに限らず、吸着面２５４の中心と実際の供給位置との部品送り方向における位置ずれが小さくなる方へ回転させる方がよいこともある。

【００８３】撮像により検出された吸着面２５４の偏心には、製造誤差等による吸着面２５４の偏心誤差も含まれるが、以上のように吸着面２５４の中心と実際の供給位置とを合わせることにより、その偏心誤差も解消されることとなる。

【００８４】このように３個のフィーダ４０により供給される電子部品２０と３個の吸着ノズル２００の吸着面２５４との位置が合わされた状態で３個の吸着ノズル２００がそれぞれホルダ昇降装置２０４により同時に一斉に下降させられ、電子部品２０を負圧により同時に一斉に吸着する。両者の位置は、吸着面２５４の中心間の距離である軸間距離の調節および電子部品２０の送り停止位置の調節によりＸ軸方向においてもＹ軸方向においても合わされており、３個の吸着ノズル２００が電子部品２０を同時に、受け取りミス等を生ずることなく、吸着

する。

【００８５】なお、前述のキャリヤテープ送り装置６６の送り誤差の検出，修正は、テーピング電子部品２０の送り停止位置の調節により、吸着面２５４と部品供給部１２２との電子部品送り方向の位置合わせが行われる場合にも同様に行われる。

【００８６】前述のように取得した位置誤差および偏心は、ノズルホルダ２０２，吸着ノズル２００およびフィーダ４０の各固有値としてＲＡＭ３０８に記憶され、吸着ノズル２００と、吸着ノズル２００に電子部品２０を供給するフィーダ４０との組合わせに応じて、ホルダ回転軸線の位置誤差，吸着面２５４の偏心および実際の供給位置の位置誤差が組み合わされ、Ｘ軸スライド１６４の移動距離の修正，軸間距離の調節，部品送り停止位置の調節が行われて、複数の吸着ノズル２００の吸着面２５４と電子部品２０との位置が合わされる。吸着ノズル２００は、原則としてプリント配線板１４への装着順に電子部品２０を受け取るが、例えば、吸着ミスが発生し、装着されなかった電子部品２０を、予め設定された装着順に割り込ませて装着する場合のように、装着順とは異なる順序で電子部品２０を受け取ることもあり、同一のフィーダ４０に対して電子部品２０を受け取る吸着ノズル２００が同じであるとは限らない。そのため、電子部品２０を供給するフィーダ４０と、フィーダ４０から電子部品２０を受け取る吸着ノズル２００との組合わせが決まれば、それぞれについて予め検出されたフィーダ４０の供給位置の位置誤差，吸着面２５４の偏心，吸着ノズル２００を保持するノズルホルダ２０２の回転軸線の位置誤差がＲＡＭ３０８から読み出され、Ｘ軸スライド１６４の移動距離の修正，吸着ノズル２００の回転による吸着面２５４の旋回，テーピング電子部品５０の送り停止位置の調節等が行われ、複数の吸着ノズル２００が複数の電子部品２０を同時に安定して吸着するようにされる。

【００８７】電子部品２０の吸着後、３個の吸着ノズル２００が上昇させられ、電子部品２０がフィーダ４０から取り出される。そして、電子部品２０の姿勢、すなわち軸線まわりの位置を吸着時と装着時とで変更するのであれば、ノズルホルダ２０２が回転させられて電子部品２０が回転させられるとともに、部品カメラ２８２上へ移動させられる。

【００８８】ノズルホルダ２０２は、その位置誤差が修正されて移動させられ、ホルダ回転軸線と撮像中心とが一致させられた状態で電子部品２０が部品カメラ２８２により撮像される。電子部品２０を撮像するためのノズルホルダ２０２の移動データは、３個のノズルホルダ２０２の各設計上の正規の回転軸線についてそれぞれ作成されており、各移動データがノズルホルダ２０２の回転軸線の位置誤差に基づいて修正されてノズルホルダ２０２が移動させられ、ホルダ回転軸線と撮像中心とが一致

させられるのであり、３個の電子部品２０が１個ずつ、順に撮像される。

【００８９】そして、撮像により得られた像データが画像処理され、誤差のない正規の像データと比較され、３個の電子部品２０の各々について保持位置誤差が演算される。保持位置誤差には中心位置誤差、すなわち電子部品２０の中心のホルダ回転軸線に対する位置誤差ΔXE，ΔYE および回転位置誤差（電子部品２０の吸着ノズル２００により吸着される被吸着面に直角な軸線まわりの位置誤差）Δθが含まれる。

【００９０】撮像後、部品装着ユニット１５０は、プリント配線板１４上へ移動させられ、３個の電子部品２０が順次、予め定められた被装着位置上へ移動させられ、装着される。３つの部品装着ユニット１５０による電子部品２０の装着は個別に行われ、電子部品２０は１個ずつ装着される。３個の電子部品２０は、順次、被装着位置へ移動させられて装着されるのであるが、電子部品装着時の移動データは、３つの部品装着ユニット１５０の各ノズルホルダ２０２のホルダ回転軸線の設計上の正規の位置の位置についてそれぞれ作成されており、移動データがホルダ回転軸線の位置誤差ΔXA，ΔYA，電子部品２０の中心位置誤差ΔXE，ΔYE，被装着位置の位置誤差ΔXP，ΔYP および回転位置誤差Δθの修正により生ずる電子部品２０の中心位置ずれに基づいて修正され、それら位置誤差が解消される。電子部品２０が被装着位置へ移動させられる途中、吸着ノズル２００が回転させられて電子部品２０の回転位置誤差Δθが修正され、電子部品２０が正規の被装着位置に正規の姿勢で装着されて電子回路の組立が行われる。

【００９１】３個の吸着ノズル２００が電子部品２０をプリント配線板１４に装着したならば、次の電子部品２０の受取りのために部品供給装置２４あるいは２６へ移動させられる。この際、ノズルホルダ２０２は回転原位置に戻される。そして、電子部品２０の受取り時には、ホルダ回転軸線等、各種位置誤差が修正され、吸着面２５４の中心と実際の供給位置とが合わされ、吸着面２５４と電子部品２０との位置が合わされて複数の吸着ノズル２００が複数の電子部品２０を同時に位置ずれ少なく、安定して吸着するようにされる。

【００９２】以上の説明から明らかなように、本実施形態においては、Ｘ軸スライド１６４が移動部材を構成し、制御装置３００のパルスモータ１００を制御し、テーピング電子部品５０の送り停止位置を調節する部分が電動モータ制御装置を構成し、送り停止位置調節装置を構成している。また、３個のノズルホルダ２０２を個別に回転させる３個のホルダ回転装置２０６が３個の吸着ノズル２００の吸着面２５４の中心間のＸ軸方向に平行な方向の距離である軸間距離を調節する軸間距離調節装置を構成している。また、基準マークカメラ２７４が供給部認識装置を構成し、画像処理コンピュータ３１６が、基準マークカメラ２７４によるゲージテープ３５０の撮像により得られる像データに基づいて、部品供給部１２２の電子部品２０の送り方向に直角な方向における位置と、電子部品２０の送り停止位置とを取得する供給位置取得装置を構成している。部品カメラ２８２が吸着部認識装置を構成し、画像処理コンピュータ３１６が、部品カメラ２８２による吸着面２５４の撮像により得られる像データに基づいて、吸着面２５４の偏心を取得する部分が吸着部位置取得装置を構成している。さらに、制御装置３００の、供給位置取得装置および吸着部位置取得装置により取得された位置に基づいてパルスモータ１００および回転用モータ２４０を制御し、複数の吸着ノズル２００の各吸着面２５４と複数のフィーダ４０により供給される複数の電子部品２０とのＸ軸方向およびＹ軸方向にそれぞれ平行な方向の相対位置を調節し、複数の吸着面２５４と電子部品２０との位置を合わせた状態で吸着ノズル２００に複数の電子部品２０を一斉に吸着保持させる部分が部品受取制御装置を構成している。

【００９３】上記実施形態においては、３個の吸着ノズル２００の各吸着部が被保持部に対して偏心させられ、吸着ノズル２００の軸間距離は、吸着ノズル２００を回転させ、吸着面２５４を旋回させることにより調節され、それにより電子部品２０と吸着ノズル２００との部品送り方向に直角な方向の位置合わせが行われるようにされていたが、複数のノズルホルダをそれぞれ、部品送り方向に直角な方向に移動させることにより吸着ノズルの軸間距離を調節し、位置誤差を修正して位置を合わせるようにしてもよい。その実施形態を図１７ないし図１９に基づいて説明する。なお、上記実施形態の構成要素と同じ作用を為す構成要素には同一の符号を付して対応関係を示し、説明を省略する。

【００９４】本実施形態の電子部品装着システムにおいては、ＸＹロボット１５２を構成する移動部材たるＸ軸スライド１６４に複数、本実施形態においては３組の部品装着ユニット４００がＸ軸方向に平行な方向に並んで保持されている。これら３組の部品装着ユニット４００のうち、中央の部品装着ユニット４００はＸ軸スライド１６４に位置を固定して保持され、左右両側の部品装着ユニット４００は、Ｘ軸方向に平行な方向に移動可能に設けられている。

【００９５】３組の部品装着ユニット４００は、２組の部品装着ユニット４００がＸ軸スライド１６４および中央の部品装着ユニット４００に対してＸ軸方向に移動させられてノズルホルダ２０２の軸間距離が調節されることを除いて、前記部品装着ユニット１５０と同様に構成されている。部品装着ユニット４００はユニット本体４０４を備え、そのユニット本体４０４に吸着ノズル４３０，ノズルホルダ２０２，ホルダ昇降装置２０４，ホルダ回転装置２０６等が設けられており、中央の部品装着ユニット４００は、ユニット本体４０４においてＸ軸ス

ライド１６４に固定され、両側の部品装着ユニット４００はユニット本体４０４に設けられた被案内部材たるガイドブロック４０６において、Ｘ軸スライド１６４にＸ軸方向に平行に設けられた案内部材たるガイドレール４０８に移動可能に嵌合されている。これらガイドブロック４０６およびガイドレール４０８が案内装置４１０を構成している。また、吸着ノズル４３０においては、吸着管４３２がノズル本体４３４に同心に保持され、ホルダ回転軸線上に吸着面４３６の中心が位置することが予定されている。吸着ノズル４３０の吸着部が被保持部と同心に設けられているのである。

【００９６】中央の部品装着ユニット４００のユニット本体４０４には、図１９に示すように、２個のナット４１４がＸ軸方向に平行な姿勢で回転不能かつ軸方向に移動不能に設けられるとともに、それぞれ送りねじたるボールねじ４１６が螺合されている。これら２本のボールねじ４１６はそれぞれ、左右両側の部品装着ユニット４００のユニット本体４０４に設けられた軸間距離調節用モータ４１８により回転させられる。軸間距離調節用モータ４１８は、本実施形態においては、サーボモータにより構成され、駆動源を構成しており、ユニット本体４０４に固定して設けられ、ボールねじ４１６は軸間距離調節用モータ４１８が設けられたユニット本体４０４に対して回転は可能であるが、軸方向には移動不能である。したがって、ボールねじ４１６が軸間距離調節用モータ４１８によって回転させられれば、軸間距離調節用モータ４１８が設けられた部品装着ユニット４００が案内装置４１０に案内されてＸ軸方向に移動させられ、その部品装着ユニット４００のノズルホルダ２０２がＸ軸方向に移動させられて、中央の部品装着ユニット４００のノズルホルダ２０２との軸間距離が調節され、吸着ノズル４３０の軸間距離、すなわちノズルホルダ２０２のホルダ回転軸線間の距離であって、吸着ノズル４３０の吸着面４３６の中心間の距離が調節される。本実施形態においては、ボールねじ４１６，ナット４１４，軸間距離調節用モータ４１８等がホルダ移動装置４２０を構成し、軸間距離調節装置を構成している。軸間距離調節用モータ４１８の回転角度は、エンコーダ４２２により検出され、図示を省略する制御装置のコンピュータに入力される。

【００９７】本実施形態においても、前記実施形態におけると同様に、電子部品２０のプリント配線板１４への装着作業の開始に先立ってホルダ回転軸線の位置誤差，吸着面４３６の中心位置誤差およびフィーダの供給位置の位置誤差が検出される。本実施形態においては、吸着管４３２がノズル本体４３４に同心に保持されているため、吸着面４３６の中心のホルダ回転軸線に対するずれは、製造誤差等に基づいて生ずる位置誤差である。

【００９８】ホルダ回転軸線の位置誤差の検出は、前記実施形態におけると同様に、３個の部品装着ユニット４００が部品カメラへ移動させられ、吸着ノズル４３０の吸着面４３６を２つの回転位置において撮像することにより検出される。この際、左右両側の部品装着ユニット４００は、Ｘ軸スライド１６４に対して、Ｘ軸方向において予め設定された原位置に位置させられる。原位置は、３つの部品装着ユニット４００のホルダ回転軸線のＸ軸方向におけるピッチが、予め設定されたピッチであって、フィーダの正規の保持ピッチの整数倍となる位置であり、軸間距離調節用モータ４１８の回転角度を検出するエンコーダ４２２の検出値により得られる。また、吸着面４３６の撮像は、例えば、ノズルホルダ２０２が回転原位置と、回転原位置から１８０度隔たった回転位置との２つの回転位置において行われる。吸着ノズル４３０の吸着面４３６の中心位置誤差は、ノズルホルダ２０２が吸着ノズル４３０を保持し、回転原位置に位置する状態で吸着面４３６が撮像され、その撮像データに基づいて取得される。吸着面４３６の中心のホルダ回転軸線に対するずれが位置誤差として取得されるのである。

【００９９】そして、複数の吸着ノズル２００が同時に電子部品２０をフィーダから取り出す場合には、複数ずつの吸着面４３６の中心と供給位置とのＸ軸，Ｙ軸方向における各位置がそれぞれ合わされ、複数の吸着面４３６と電子部品２０との位置が合わされるのであるが、中央の部品装着ユニット４００についてはＸＹロボット１５２の移動の制御により、吸着ノズル２００の吸着面２５４の中心がＸ軸方向においてもＹ軸方向においても、供給位置と一致させられる。ＸＹロボット１５２のＸ軸スライド１６４，Ｙ軸スライド１６０の移動データは、中央の部品装着ユニット４００のホルダ回転軸線の設計上の正規の位置について、供給位置とＸ軸，Ｙ軸方向において一致するように作成され、その移動データがホルダ回転軸線，吸着面２５４および供給位置の各Ｘ軸，Ｙ軸方向の位置誤差に基づいて修正されてＸ軸スライド１６４，Ｙ軸スライド１６０が移動させられ、吸着面２５４と電子部品２０との位置がＸ軸方向においても、Ｙ軸方向においても合わされるのである。この際、ノズルホルダ２０２は回転原位置に位置させられる。

【０１００】左右の部品装着ユニット４００の吸着ノズル２００については、フィーダの供給位置，ホルダ回転軸線および吸着面４３６の各Ｘ軸方向の位置誤差に加えて、中央の部品装着ユニット４００の吸着面４３６の中心と供給位置とを合わせるためのＸ軸方向における位置誤差修正量に基づいて、吸着面４３６の中心と供給位置とのＸ軸方向における位置が合うようにノズルホルダ２０２がホルダ移動装置４２０によって移動させられ、中央の部品装着ユニット４００のノズルホルダ２０２の軸線との距離が調節され、吸着面４３６の中心と実際の供給位置とがＸ軸方向において合わされる。この調節のためのノズルホルダ２０２の移動量および移動方向は、ノズルホルダ２０２が回転原位置に位置し、Ｘ軸方向にお

いて原位置に位置する状態において設定される。ノズルホルダ２０２は、部品供給装置からの電子部品の受取り後、電子部品の撮像に先立ってＸ軸方向において原位置に戻される。また、電子部品の装着後、回転方向においても原位置に戻され、電子部品を受け取る際には回転方向においてもＸ軸方向においても原位置にあり、Ｘ軸方向の原位置および回転原位置において設定された移動量および方向に基づいてノズルホルダ２０２のＸ軸方向における位置が調節され、ノズルホルダ２０２の軸間距離が調節される。

【０１０１】左右の部品装着ユニット４００については、吸着面４３６と供給位置とのＹ軸方向の位置合わせは、電子部品２０の送り停止位置の調節により行われる。送り停止位置は、ホルダ回転軸線，吸着面４３６および実際の供給位置の各Ｙ軸方向における位置誤差と、中央の部品装着ユニット４００の吸着ノズル４３０の吸着面４３６の中心と実際の供給位置とのＹ軸方向の位置を合わせるための移動データの修正量とに基づいて、吸着面４３６の中心と供給位置とがＹ軸方向において一致するように調節される。このようにノズルホルダ２０２の移動によって軸間距離が調節されるとともに、部品送り停止位置の調節が成された状態で３個の吸着ノズル４３０が下降させられ、同時に一斉に電子部品を吸着する。

【０１０２】電子部品の吸着後、吸着ノズル４３０が上昇させられるとともに、左右のノズルホルダ２０２がＸ軸方向において原位置に戻される。そして、前記実施形態におけると同様に、電子部品が１個ずつ撮像され、中心位置誤差および回転位置誤差等が修正されてプリント配線板に１個ずつ装着される。このようにノズルホルダ２０２をＸ軸方向に移動させて軸間距離を調節し、吸着ノズル２００と電子部品との位置合わせを行う場合、その調節によって吸着面４３６にＹ軸方向の位置ずれを生ずることなく、調節が行われる。

【０１０３】上記各実施形態において、部品供給部１２２の部品送り方向に直角な方向における位置およびフィーダ４０における電子部品２０の送り停止位置は、ゲージテープ３５０を用いて検出されていたが、ゲージテープを用いることは不可欠ではない。例えば、図２０に示すように、テーピング電子部品に被せるカバー１１５に基準マーク４４０を設け、その基準マーク４４０を基準マークカメラ２７４によって撮像することにより、実際の供給位置の位置誤差を取得するようにしてもよい。基準マーク４４０は、カバー１１５の開口１１７の近傍に設けられている。基準マーク４４０は種々の形状が採用可能であり、例えば、図２０に示すように十字形でもよく、あるいは円形でもよく、三角形、正方形あるいは長方形等の矩形等の多角形でもよい。基準マーク４４０は、例えば、印刷により設けてもよく、シールの貼付により設けてもよく、凸部あるいは凹部を設けることにより設けてもよい。いずれにしても基準マーク４４０は、カバー１１５の基準マーク４４０が設けられた部分に対して光学的特性が異ならされ、基準マークカメラ２７４による撮像時に明瞭に区別可能な像が形成されるように設けられる。

【０１０４】基準マーク４４０の撮像時には、基準マークカメラ２７４は予め設定された移動データに従って移動させられる。この移動データは、基準マークカメラ２７４が、その撮像中心が、基準マーク４４０の中心の設計上の正規の位置と一致するように作成されており、基準マーク４４０の撮像により得られる像データが画像処理され、基準マーク４４０の像の中心の撮像中心に対する位置誤差が求められる。この位置誤差は基準マーク４４０の正規の位置に対する誤差である。基準マーク４４０は開口１１７の近傍に設けられ、部品供給部１２２の近傍に設けられているため、基準マーク４４０の位置誤差が実際の供給位置の位置誤差とみなされる。なお、テーピング電子部品にカバーが被せられないのであれば、フィーダ本体に基準マークを設ければよい。

【０１０５】供給位置の位置誤差は、テーピング電子部品５０に保持された電子部品２０であって、供給位置へ移動させられた電子部品２０を撮像することにより検出するようにしてもよい。電子部品２０は、部品収容凹部５２に僅かではあるが隙間を有して収容されている。そのため、電子部品２０の部品収容凹部５２内における位置は一定であるとは限らず、図２１に示すように、電子部品２０によって異なるのが普通である。なお、図２１においては、隙間が誇張して図示されている。

【０１０６】したがって、部品供給部１２２の位置の検出時には、基準マークカメラ２７４により、電子部品２０を複数、撮像する。基準マークカメラ２７４は予め設定された移動データに基づいて、設計上の正規の供給位置と撮像中心とが一致する位置へ移動させられて、部品供給部１２２に位置する電子部品２０を撮像する。電子部品２０が撮像される毎にテーピング電子部品５０が１ピッチずつ送られ、複数の電子部品２０が撮像される。そして、複数の電子部品２０の各像データが画像処理され、その中心と撮像中心とのＸ軸，Ｙ軸における各位置誤差が求められるとともに、複数の電子部品２０の各位置誤差の平均値が求められ、実際の供給位置の位置誤差とされる。撮像された複数の電子部品２０の各中心位置の平均位置が実際の供給位置とみなされ、位置誤差の平均値が実際の供給位置の位置誤差とされるのである。

【０１０７】キャリヤテープ送り装置６６においてテーピング電子部品５０の送り誤差の修正は、テーピング電子部品５０が１回（１ピッチ分）、送られる毎に行われるようにしてもよい。例えば、パルスモータ１００の回転に対してスプロケット１１２の回転が設定された回転角度より大きい角度回転し、図２２(a) に示すように、パルスモータ１００が設計上、設定された回転角度θMU

回転する前に光電センサ１２４の検出信号がＯＦＦ信号からＯＮ信号に変わり、テーピング電子部品５０の送り長さが１ピッチより長くなる場合には、電子部品５０の次の送りが行われる場合に、光電センサ１２４の検出信号がＯＦＦ信号からＯＮ信号に変わったときのパルスモータ１００の回転角度θMSを０として送りを行うのである。また、パルスモータ１００の回転に対してスプロケット１１２の回転が設定された回転角度より小さい角度回転し、図２２(b) に示すように、パルスモータ１００が設計上、設定された回転角度θMU回転した後に光電センサ１２４の検出信号がＯＦＦ信号からＯＮ信号に変わり、テーピング電子部品５０の送り長さが１ピッチより短くなる場合には、電子部品５０の次の送りが行われる場合に、パルスモータ１００が起動された後、光電センサ１２４の検出信号がＯＦＦ信号からＯＮ信号に変わったときのパルスモータ１００の回転角度θMSを０として送りを行う。

【０１０８】前記実施形態において、吸着ノズル２００を回転させ、吸着面２５４をホルダ回転軸線まわりに旋回させて、位置ずれを解消する場合、その解消に伴って生ずる吸着面２５４のＹ軸方向の位置ずれが、部品送り停止位置の調節により修正され、解消されるようにされていたが、解消することは不可欠ではない。例えば、旋回による吸着面２５４のＹ軸方向の位置ずれが小さければ、解消しなくてもよい場合があるのである。

【０１０９】この場合、図２３に示すように、まず、吸着面２５４の旋回によるＸ軸方向における位置誤差の修正可能量±ｗ、および、吸着面２５４が、ホルダ回転軸線を通り、Ｙ軸に平行な直線上にある状態から、修正可能量±ｗを修正するために旋回することによってＹ軸方向に生じることが許容される吸着面２５４の位置ずれ量Ｌが決定される。そして、その許容位置ずれ量Ｌ以内において修正可能量±ｗを実現するために必要な旋回半径Ｒが演算される。同じ量のＸ軸方向の位置誤差を修正した場合に、Ｙ軸方向において生じる吸着面２５４の位置ずれは、旋回半径Ｒが大きいほど小さくて済み、一般的には、旋回半径ＲがＹ軸方向における許容位置ずれ量Ｌの３倍，５倍あるいは１０倍以上となるように選定されることが望ましい。

【０１１０】なお、上記各実施形態において、ホルダ回転軸線，吸着面，部品供給部の位置は、電子部品の装着作業の開始に先立って検出されるようにされていたが、一連の装着作業の途中であって、予め設定された検出条件が成立したときに検出し、新たに検出された位置誤差（吸着面が偏心させられているときには偏心も）に基づいて吸着ノズルの軸間距離の調節，電子部品の送り停止位置の調節を行うようにしてもよい。検出条件は、例えば、装着作業の開始から設定時間が経過したこと，設定枚数のプリント配線板への電子部品の装着が行われたこと，１つのフィーダによる電子部品の供給数が設定数に達したこと等である。

【０１１１】また、上記各実施形態において、フィーダ保持装置によるフィーダの保持ピッチは一定とされていたが、複数種類に異ならせてもよい。複数種類の保持ピッチは、例えば、最小の保持ピッチの整数倍の大きさとされる。

【０１１２】さらに、吸着ノズルの吸着部が保持部に対して偏心させられている場合、機械的に検出されるノズルホルダの回転原位置において、吸着面と供給位置とのＸ軸方向の位置ずれを解消し、位置を合わせるためのノズルホルダの回転角度および方向が求められるようにされていたが、吸着ノズルをノズルホルダに保持させ、吸着管がホルダ回転軸線に対して予め設定された位置に位置する状態におけるエンコーダの値を記憶し、その位置をノズルホルダの回転原位置としてもよい。

【０１１３】また、複数の吸着ノズルの全部について吸着部を被保持部に対して偏心させ、吸着面の旋回によって軸間距離を調節する場合、電子部品の受取り時に、移動部材の移動距離を修正せず、全部の吸着ノズルについて同様に、吸着面の旋回による軸間距離の調節および部品送り停止位置の調節によって複数の吸着ノズルと複数の電子部品との位置を合わせるようにしてもよい。

【０１１４】さらに、吸着ノズルの吸着部を被保持部に対して偏心させ、吸着面の旋回によって軸間距離を調節する場合、複数の吸着ノズルうちの１つを吸着部と被保持部とが同心の吸着ノズルとし、その吸着ノズルについては、供給位置に対する移動量の修正により、吸着面の中心と供給位置とが合わされるようにしてもよい。

【０１１５】また、吸着ノズルの吸着部を被保持部に対して意図的に偏心させる場合、前記実施形態におけるように吸着面２５４をノズル本体２５０に対して偏心させてもよく、ノズルホルダをその回転軸線に対して偏心させてもよい。

【０１１６】また、ノズルホルダを第二直線に平行な方向に移動させて、ノズルホルダの軸間距離を調節する場合、ホルダ移動装置は、ボールねじおよびナットを含む装置に限らず、ラックおよびピニオンを含む装置としてもよく、あるいはリンク機構，カム機構を含む装置としてもよい。

【０１１７】以上、本発明のいくつかの実施形態を詳細に説明したが、これらは例示に過ぎず、本発明は、前記〔発明が解決しようとする課題，課題解決手段および効果〕の項に記載された態様を始めとして、当業者の知識に基づいて種々の変更、改良を施した形態で実施することができる。

【図面の簡単な説明】

【図１】本発明の実施形態である電子部品装着システムを概略的に示す平面図である。

【図２】上記電子部品装着システムを示す側面図である。

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【図３】上記電子部品装着システムの部品装着装置を示す正面図（一部断面）である。

【図４】上記部品装着装置の吸着ノズルを示す底面図である。

【図５】上記電子部品装着システムの部品供給装置を構成するフィーダがフィーダ支持テーブルに保持された状態を示す正面図（一部断面）である。

【図６】上記フィーダにセットされたテーピング電子部品を示す平面図である。

【図７】上記テーピング電子部品を示す側面断面図である。

【図８】上記フィーダにおいてテーピング電子部品に被せられたカバーを示す平面図である。

【図９】上記フィーダのテープ送り装置のスプロケットを示す側面断面図である。

【図１０】上記テープ送り装置によるテーピング電子部品の送り時に生ずる誤差およびその修正を説明するグラフである。

【図１１】上記電子部品装着システムを制御する制御装置のうち、本発明に関連の深い部分を示すブロック図である。

【図１２】上記吸着ノズルを保持するノズルホルダの回転軸線の位置の検出を説明する図である。

【図１３】上記吸着ノズルの吸着面の位置ずれの検出を説明する図である。

【図１４】上記フィーダの部品供給部の位置誤差の検出に用いるゲージテープを示す平面図である。

【図１５】上記フィーダの部品供給部の位置誤差，ホルダ回転軸線の位置誤差および吸着面の位置ずれを示す図である。

【図１６】上記吸着ノズルによる電子部品の吸着時における位置誤差等の修正を説明する図である。

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【図１７】本発明の別の実施形態である電子部品装着システムの部品装着装置を示す側面図である。

【図１８】図１７に示す部品装着装置を示す正面図（一部断面）である。

【図１９】図１７に示す部品装着装置を示す平面図である。

【図２０】フィーダの部品供給部の位置誤差の検出の別の実施形態を説明する図である。

【図２１】フィーダの部品供給部の位置誤差の検出の別の実施形態を説明する図である。

【図２２】フィーダのキャリヤテープ送り装置によるテーピング電子部品の送り誤差の修正の別の実施形態を説明する図である。

【図２３】吸着ノズルの吸着面の旋回による軸間距離の調節時に、旋回によるＹ軸方向の位置ずれの解消が不要な場合の吸着面の偏心量の設定を説明する図である。

【符号の説明】

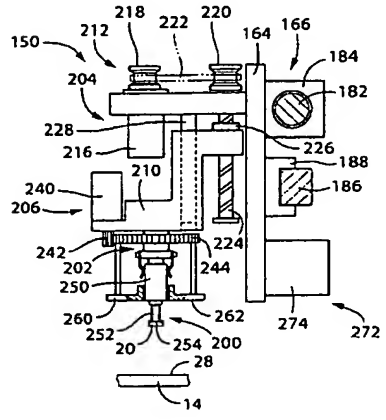
１４：プリント配線板　　１８：配線板保持装置　　２０：電子部品　　２２：部品装着装置　　２４，２６：部品供給装置　　４０：フィーダ　　４８：キャリヤテープ　　５０：テーピング電子部品　　６６：キャリヤテープ送り装置

１００：パルスモータ　　１５０：部品装着ユニット　　１５２：ＸＹロボット　　１６４：Ｘ軸スライド　　２００：吸着ノズル　　２０２：ノズルホルダ　　２０６：ホルダ回転装置　　２５４：吸着面　　２７４：基準マークカメラ　　２８２：部品カメラ　　３００：制御装置　　３５０：ゲージテープ

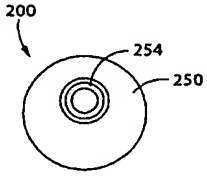
４００：部品装着ユニット　　４２０：ホルダ移動装置　　４３０：吸着ノズル

４３２：吸着管　　４３６：吸着面

【図３】



【図４】



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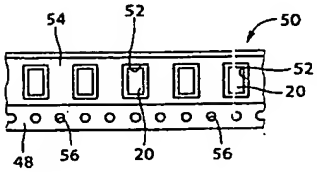

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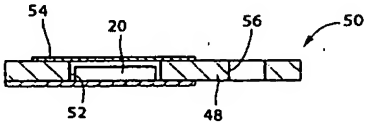

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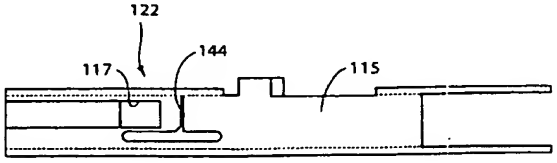

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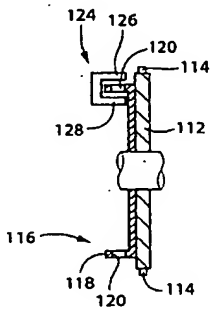
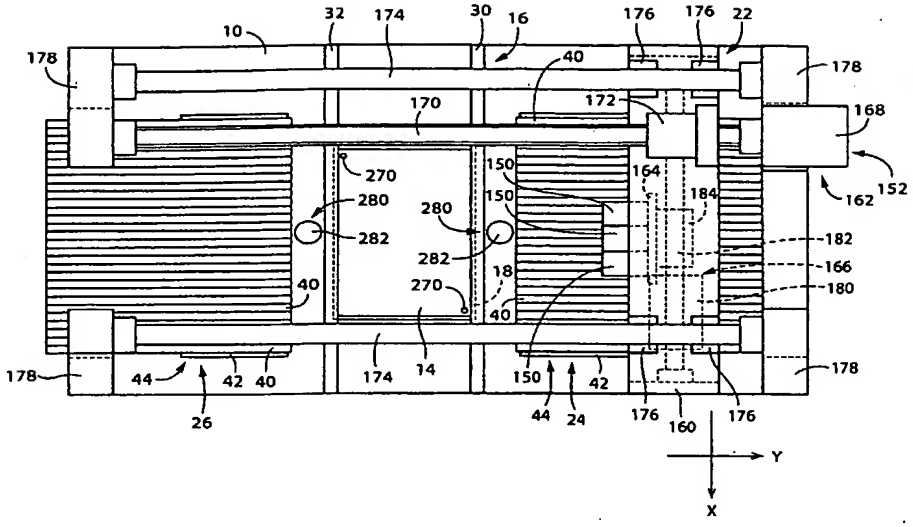
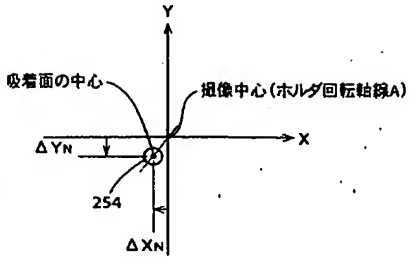


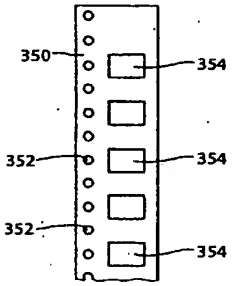
【図１】



【図１３】



【図１４】



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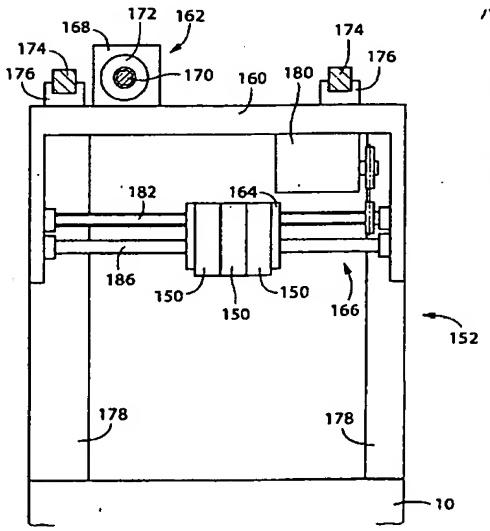

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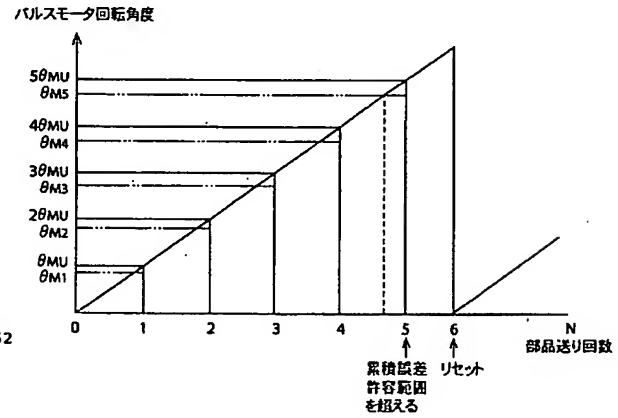
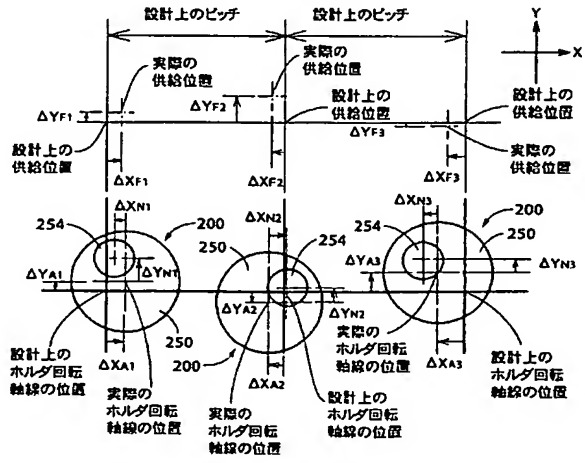
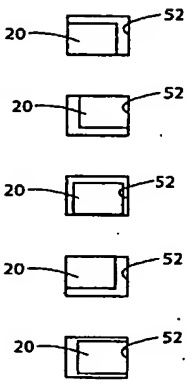


【図１５】



【図２１】



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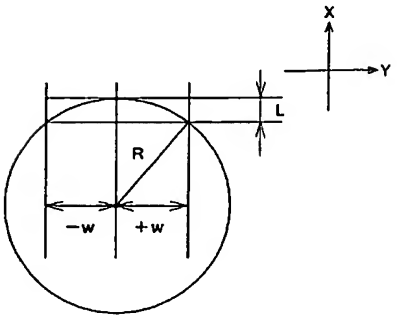
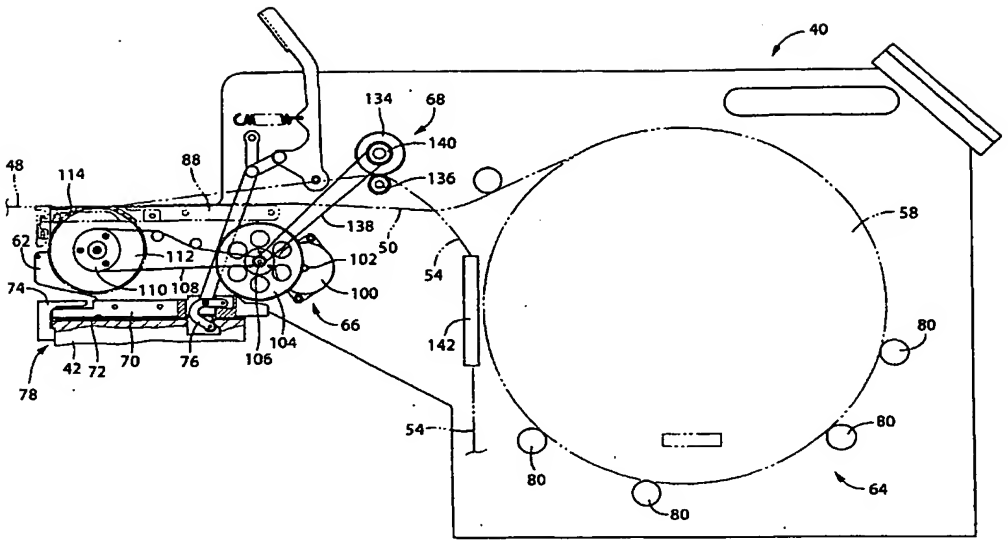
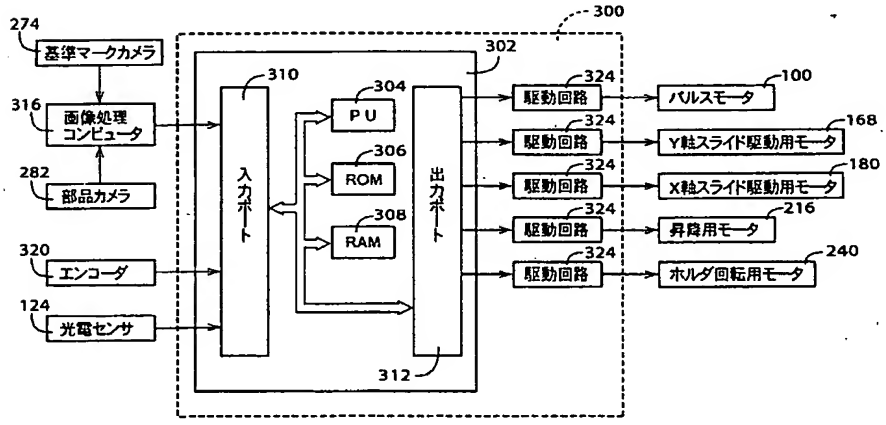


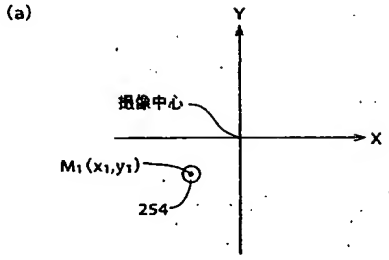
【図５】



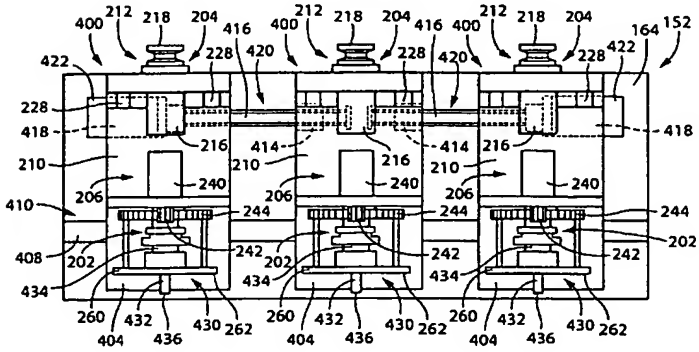
【図１１】

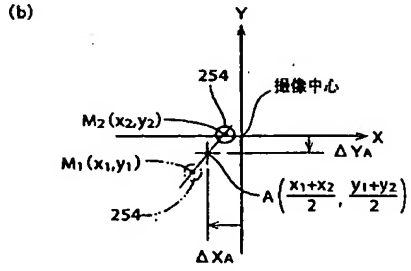


【図１２】

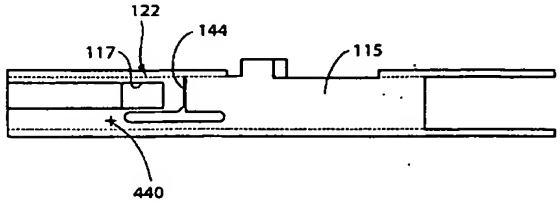


【図１７】

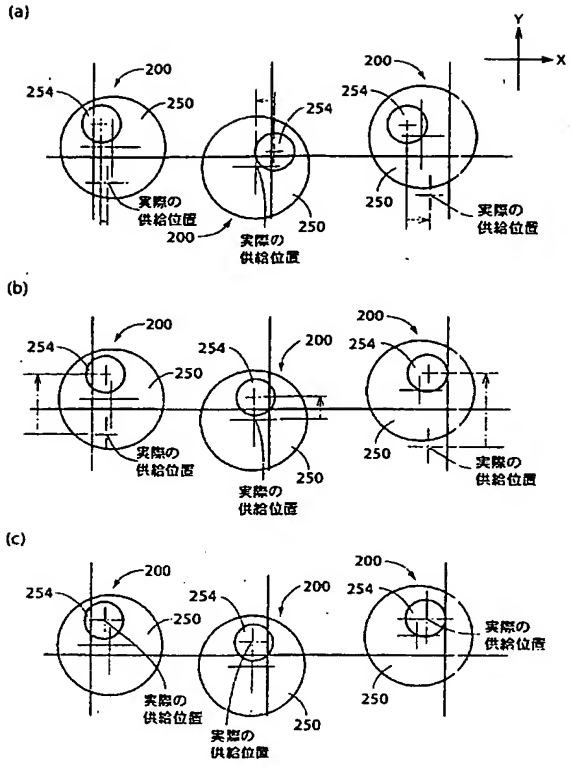




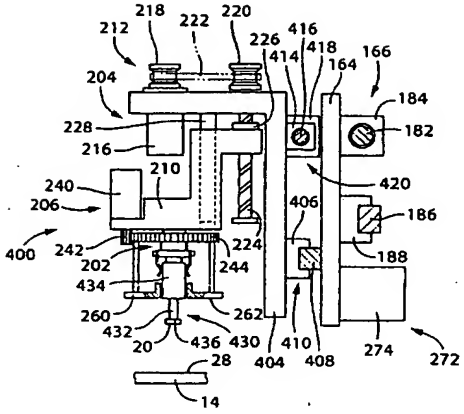
【図２０】



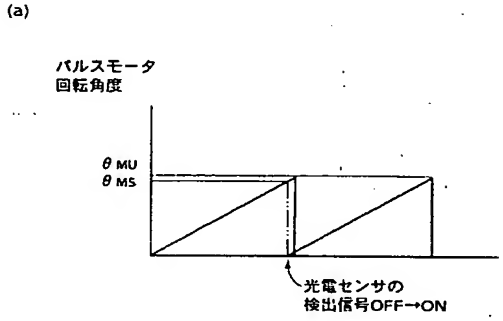
【図１６】



【図１８】



【図２２】



【図１９】